1r10019r2

REPORT FOR

AIR QUALITY ASSESSMENT

AT

CROWN STREET PHASE 2 (PHASE D), MANCHESTER

PREPARED FOR

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QUALITY ASSURANCE

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EXECUTIVE SUMMARY

The following Air Quality Assessment has been undertaken and produced by Planning and Environmental Consultants (PEC) Ltd on behalf of Renaker Build Limited, in support of the proposed development at Crown Street Phase 2 (Phase D), Manchester.

The proposals comprises the development of a car park, alongside associated Infrastructure.

The application site is located within an area identified by the Manchester City Council as experiencing elevated pollutant concentrations. Subsequently, the Proposed Development has potential to introduce future users to poor air quality as well as, to cause impacts during the construction and operational phases. An Air Quality Assessment is therefore required to determine the baseline conditions at the site, assess site suitability for the proposed end-use and consider effects as a result of the development.

Potential construction phase air quality impacts from fugitive dust emissions were assessed as a result of earthworks, construction and trackout activities. It is considered that the use of good practice control measures would provide suitable mitigation for a development of this size and nature and reduce potential impacts to an acceptable level.

Dispersion modelling was undertaken in order to predict annual mean pollutant concentrations across the application site and to predict impacts as a result of additional road vehicle exhaust emissions associated with the proposed development. Results were subsequently verified using local monitoring data provided by Manchester City Council.

The dispersion modelling results indicated that annual mean pollutant concentrations across the application site were below the relevant air quality objectives at proposed sensitive locations. The site is therefore considered suitable for proposed end use without the implementation of protective mitigation techniques.

Additionally, the assessment concluded that impacts on pollutant levels as a result of operational phase pollutant emissions were predicted to be **not significant** at all sensitive locations in the vicinity of the site, as a result of **negligible and slight impacts** at discrete sensitive receptor locations. The use of robust assumptions, where necessary, was considered to provide sufficient results confidence for an assessment of this nature.

Electric Vehicle Charging infrastructure will be installed at 39 of the 389 planned car parking spaces on site. Of the 39 electric vehicle charging spaces, half will be 7kw and half will be 22kw providing faster charging.

Based on the assessment results the site is considered suitable for the proposed end use and complies with the MCC Local Plan and National Planning Policy Framework.

1 INTRODUCTION

1.1 BACKGROUND

Planning and Environmental Consultants (PEC) ltd have been commissioned by Renaker Build Limited, hereafter referred to as "the Client" to undertake an Air Quality Assessment in support of a planning application for the development of Crown Street Phase 2 (phase D), herein after referred to as the "Proposed Development".

An Air Quality Environmental Impacts Assessment (EIA) was produced in support of a hybrid planning application for Crown Street Phase 2. Crown Street Phase 2 was approved under application 126668/FO/2020 on 3 August 2020. The hybrid planning permission established the principle of development for the outline phase, for Phase D (Public Park and carpark).

Following the submission of the planning application (ref: 126668/FO/2020) to Manchester City Council (MCC), planning permission for the development was granted subject to the following planning condition in relation to Air Quality. Condition 121 requests the following:

> *Prior to first occupation of Phase D, an Air Quality Impact Assessment (AQIA) shall be submitted to and approved in writing by the Local Planning Authority. The AQIA shall include full details of all mitigation measures required for the development. Any agreed mitigation measures shall be implemented in full before first occupation of the development and shall remain in situ whilst the development is in operation.*

1.2 SITE LOCATION AND CONTEXT

The application site is located at Crown Street Phase 2 at approximate National Grid Reference (NGR) 383160, 397250. Reference should be made to Figure 1 within Appendix A for a location plan.

The application site is located within the Greater Manchester Combined Authority (GMCA) Air Quality Management Area (AQMA) which has been declared due to exceedances of the annual mean Air Quality Objective (AQO) for nitrogen dioxide (NO2). Subsequently, the Proposed Development has the potential to introduce future residential occupants into an area of elevated NO2 and particulate matter (PM10 and PM2.5) concentrations, as well as to cause impacts at sensitive receptor locations during the construction and operational phases.

An Air Quality Assessment has therefore been produced to quantify annual mean NO2, PM10 and PM2.5 concentrations across the site to consider suitability for the proposed end-use, and to assess potential impacts as a result of the development. The assessment will be undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and the MCC Local Planning Policy.

1.3 LIMITATIONS

This report has been produced in accordance with PEC Ltd standard terms of engagement. This report is solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from PEC Ltd at which point a charge may be levied against such approval.

2 LEGISLATION, GUIDANCE AND POLICY

The following legislation, guidance and policy will be considered and adhered to during the preparation of the Air Screening Quality Assessment:

-
- European Union (EU) Directive 2008/50/EC;
- The NPPF, updated on 20th July 2021);
- The National Planning Practice Guidance (NPPG), relevant chapters produced on 1st November 2019;
- Section 82 of the Environment Act (Part IV), updated 9th November 2021;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs (DEFRA), 2007[1];
- The Air Quality Standards (Amendment) Regulations (2016);
- Local Air Quality Management Technical Guidance 2022 LAQM.TG(22), DEFRA, August 2022[2];
- Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management (IAQM), v1.1, June 2016[3];
- Land-Use Planning and Development Control: Planning for Air Quality, Environmental Protection UK (EPUK) and IAQM, January 2017[4];
- Manchester's Local Development Framework, Core Strategy Development Plan Document, MCC, July 20125; and
- Air Quality & Planning Technical Guidance, MCC, August 2022[6]

2.1 UK LEGISLATION AND GUIDANCE

The Air Quality Standards (Amendment) Regulations (2016) came into force on 31st December 2016. These Regulations amend the Air Quality Standards Regulations 2010 and transpose the EU Directive 2008/50/EC into UK law. Air Quality Limit Values (AQLVs) were published in these regulations for 7 pollutants, as well as Target Values for an additional 6 pollutants.

Part IV of the Environment Act (2021) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published in July 2007[1]. The AQS sets out Air Quality Objectives (AQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale. These are generally in line with the AQLVs, although the requirements for compliance vary slightly.

Table 1 presents the AQOs for pollutants considered within this assessment.

Table 1: Air Quality Objectives

Pollutant	Air Quality Objectives	
	Concentration (µg/m³)	Averaging Periods
NO_2	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM_{10}	40	Annual mean
	50	24-hour mean; not to be exceeded more than 35 times a year
$PM_{2.5}$	25	Annual mean

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007
2 Local Air Quality Management Technical Guidance 2022 LAQM.TG(22), DEFRA, 2022
3 Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2016
4 Land-Use Planning and Development Control: Planning for Air Quality, EPUK and IAQM, 2017
5 Manchester's Local Development Framework, Core Strategy Development Plan Document, MCC, 2012
6 Air Quality & Planning Technical Guidance, MCC, 2022

Table 2 summarises the advice provided in DEFRA guidance LAQM.TG(16)[2] on where the AQOs for pollutants considered within this report apply.

Table 2: Examples of Where the Air Quality Objectives Apply

Averaging Periods	Objectives Should Apply At	Objectives Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

The monitoring results provided by MCC and background concentrations provided by DEFRA will be compared against the relevant AQOs detailed in Table 1 to determine onsite exposure.

2.2 LOCAL PLANNING POLICY

The Manchester Local Development Framework (LDF) Core Strategy[5] was formally adopted in 2012 and provides a framework for development within the City. The LDF comprises a number of documents which set out MCC's spatial policy framework A review of the Core Strategy indicated the following policy in relation to air quality that is relevant to this assessment:

- Policy EN16 – Air Quality
- Policy CC5 – Transport; and
- Policy DM1 – Development Management

Reference has been made to these policies during the undertaking of this Air Quality Assessment by assessing the impacts of road vehicle exhaust emissions on future site users.

3 METHODOLOGY

There is the potential for the Proposed Development to expose future site users to elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations, as well as to cause impacts at sensitive locations during the construction and operational phases. This has been assessed in accordance with the following methodology

3.1 CONSTRUCTION PHASE ASSESSMENT

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the IAQM document 'Guidance on the Assessment of Dust from Demolition and Construction'[3].

Reference should be made to Appendix C for details of the relevant IAQM construction phase assessment criteria, which were utilised in conjunction with site specific information

Activities on the proposed construction site have been divided into three types to reflect their different potential impacts. These are:

- Earthworks;
- Construction; and
- Trackout

The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in exposure to PM_{10} and $PM_{2.5}$

A desk top survey will be undertaken to identify human and ecological receptors within the relevant assessment buffers specified by the IAQM guidance[3]. Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

Following the identification of sensitive receptors, a site is then allocated a risk category which is assigned to each activity, based on the scale and nature of the works, as well as the sensitivity of the area to dust impacts.

The assigned magnitude and sensitivity will then determine the overall risk and appropriate mitigation measures to be employed during construction phase activities.

The IAQM guidance[3] is provided in Appendix C, with the details of the assessor's qualifications and experience. provided in Appendix G.

3.2 OPERATIONAL PHASE ASSESSMENT

3.2.1. ROAD VEHICLE EXHAUST IMPACT ASSESSMENT

The Proposed Development has potential to cause impacts upon existing pollution levels at nearby sensitive receptors as a result of additional road vehicle exhaust emissions (NO_2, PM_{10} and $PM_{2.5}$) generated during the operational phase.

Impacts have been defined by predicting pollutant concentrations at sensitive locations with and without the Proposed Development in place using dispersion modelling and the following assessment scenarios:

- 2019 as baseline year for verification against latest ratified data;
- Opening year do-minimum (DM) (predicted traffic flows in 2024 should the proposals not proceed); and

- Opening year do-something (DS) (predicted traffic flows in 2024 should the proposals be completed, with the addition of traffic generated by the Proposed Development).

In light of expected emission improvements to the national vehicle fleet guided by government policy, it would be unrealistic not to assume a reduction to vehicle emission factors in future years, given the anticipated development year of 2024.

The 2024 scenario assumes an emission drop off based on assumptions provided by the Emission Factor Tool Kit (Eft v11.0) supported by the uptake of low emission vehicles and government incentives and targets concerning fleet proportions by 2030. The results of this scenario will form the basis of this report.

Sensitivity analysis has also been undertaken to assess associated road vehicle exhaust emissions impacts based on the use of 2024 traffic data with 2019 and emission factors obtained from the Eft v11.0 produced by DEFRA.

The sensitivity analysis assumes that vehicle emission factors will not improve in line with current predictions and future emission factors will remain consistent with those predicted for the baseline year of 2019. This has been undertaken to consider a worst-case scenario and does not form the basis of impact significance.

Reference should be made to Appendix C for full assessment input details, Appendix D for details of the full assessment results and Appendix E for sensitivity analysis.

3.2.2. EPUK AND IAQM IMPACT SIGNIFICANT CRITERIA

Receptors potentially sensitive to changes in pollutant concentrations were identified within the assessment extents. LAQM.TG(16)[2] provides the following examples of where annual mean AQOs should apply:

- Residential properties;
- Schools;
- Hospitals; and
- Care homes.

The sensitivity impact significance of each receptor was defined in accordance with the criteria shown in Table 3. These are based upon the guidance provided within the EPUK and IAQM guidance[4].

Table 3: EPUK and IAQM Assessment Significance Criteria

Long Term Average Concentration	% Change in Concentration Relative to AQO			
	1	2-5	6-10	>10
75% or less of AQO	Negligible	Negligible	Slight	Moderate
76 - 94% of AQO	Negligible	Slight	Moderate	Moderate
95 - 102% of AQO	Slight	Moderate	Moderate	Substantial
103 - 109% of AQO	Moderate	Moderate	Substantial	Substantial

The criteria shown in Table 3 is adapted from the EPUK and IAQM guidance[4] with sensitivity descriptors included to allow comparisons of various air quality impacts. It should be noted that changes of 0%, i.e. less than 0.5%, will be described as negligible in accordance with the EPUK and IAQM guidance[4].

Following the prediction of impacts at discrete receptor locations utilising the criteria in Table 3 the EPUK and IAQM guidance[4] states that this framework is to be used as a starting point to make a judgement on significance of effect but other influences might need to be accounted for. Whilst impacts might be determined as 'slight', 'moderate' or 'substantial' at individual receptors, overall effect might not necessarily be deemed as significant in some circumstances. The following factors may provide some assistance in determining the overall significance of a development:

- Number of properties affected by significant air quality impacts and a judgement on the overall balance;
- Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective will be relevant;
- The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors;
- Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a substantial increase or decrease; and
- The extent to which an objective is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3.

These factors were considered and an overall significance determined for the impact of operational phase road traffic emissions. It should be noted that the determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts.

Full details of data used for the modelling assessment are presented in Appendix C of this report.

3.2.3. FUTURE EXPOSURE

The Proposed Development is located within the GMCA AQMA. Subsequently, the proposals have potential to introduce new receptors into an area of elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations.

Detailed dispersion modelling was therefore undertaken to quantify annual mean pollutant concentrations across the site and determine suitability for the proposed use. The following modelling scenarios were utilised during the future exposure assessment:

- Opening year do-something (DS) (predicted traffic flows in 2024 should the proposals be completed, with the addition of traffic generated by the Proposed Development)

The results of the dispersion modelling assessment will also be compared against the relevant AQOs detailed in Table 1 to determine significance. Full details of data used for the modelling assessment are presented in Appendix C of this report.

4 BASELINE

Existing air quality conditions in the vicinity of the application site were identified in order to provide a baseline for assessment. These are detailed in the following sections.

4.1 LOCAL AIR QUALITY MANAGEMENT

As required by the Environment Act (2021), GMCA, in which MCC is a part of, has undertaken review and assessment of air quality within their area of administration. This process has indicated that annual mean concentrations of NO_2 are above the AQO within their administration. As such, one borough wide AQMA has been declared, the closest being described as:

- GMCA AQMA - This is the part of the Greater Manchester Combined Authority AQMA located within the Manchester City Council area.

The application site is located within GMCA AQMA. As such, there is potential for the Proposed Development to introduce future site users into an area of elevated annual mean NO_2 concentrations, and to cause air quality impacts within this sensitive area during the construction and operational phases. This has been considered within this report.

MCC has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs and as such no further AQMAs have been designated.

4.2 AIR QUALITY MONITORING

Monitoring of pollutant concentrations is undertaken by MCC using continuous and passive methods throughout their areas of administration. A review of MCC's most recent Air Quality Monitoring Data[7] indicated that there are currently 3 automatic analysers operated by MCC within the vicinity of the Proposed Development. The closest automatic monitoring station is the Manchester Oxford Road (Urban traffic analyser), located approximately 1km east of The Site at the NGR: 384233, 397287. The monitoring location is classified as a Kerbside site and as such has not been considered further in the context of the assessment or within the verification process. This is in accordance with LAQM (TG16) which suggests that the inclusion of Kerbside sites within the verification procedure may lead to an over-adjustment of modelling at roadside sites. This may then lead to inaccuracies during the modelling of potential exposure across the Proposed Development and potential impacts at nearby sensitive receptor locations.

MCC also monitor NO_2 concentrations across the borough using passive diffusion tubes. A review of the most recent air quality monitoring data indicated 2 diffusion tubes located within the vicinity of the application site, presented in Table 4.

Table 4: NO_2 Diffusion Tube Monitoring Results

ID	Site Name	Type	NGR (m)		Dist' to Site (m)	Annual Mean Concentration (µg/m³)		
			X	Y		2017	2018	2019
MAN77	Hewitt Street	Urban Centre	383602	397488	520	39.2	**41.0**	**43.66**
MAN97	97	Urban Traffic	382886	397215	276	-	-	32.29

As indicated in Table 4, the annual mean AQO for NO_2 was exceeded at diffusion tubes MAN77 locations in recent years. This is likely due to their roadside location within an AQMA.

[7] MCC Air Quality Annual Status Report 2021, MCC, 2021

Neighbouring Salford City Council (SCC) also monitor NO_2 concentrations across the borough using passive diffusion tubes. A review of the most recent air quality monitoring data indicated[8] diffusion tubes located within the vicinity of the application site, presented in Table 5.

Table 5: SCC Diffusion Tube Monitoring Results

ID	Site Name	Type	NGR (m)		Dist' to Site (m)	Annual Mean Concentration (µg/m³)		
			X	Y		2017	2018	2019
SA59	West Crown Avenue	Urban Traffic	381822	397895	1,470	36.7	33.3	32.4
SA60	Regent Road	Urban Traffic	382445	397724	840	40.70	40.23	36.66
SA81	81	Urban Traffic	382571	397718		-	-	46.40

As indicated in Table 4 and Table 5 , there were exceedances of the annual mean AQO for NO_2 at all monitoring location in recent years. Exceedances are likely due to their roadside locations within and AQMAs.

Reference should be made to Figure 2 within Appendix A for a graphical representation of the monitoring locations.

4.3 BACKGROUND POLLUTANT CONCENTRATIONS

The total concentration of a pollutant is comprised of explicit local emission sources (such as roads and industrial sources) and the background component. The background component consists of indeterminate sources which are transported into an area from further away by meteorological conditions. Background pollutant concentrations are therefore the ambient level of pollution that is not affected by local sources of pollution.

In reality, it is not usually practical to obtain a true representation of background levels in urban areas due to corruption by local sources; background levels used in assessments may contain a mixture of both sources.

Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The Proposed Development site is located across grid square:

- NGR: 383500, 397500

Data for this location was downloaded from the DEFRA website[9]. For the purpose of this assessment, background concentrations are summarised in Table 6 for the current base year (2019) and the predicted development opening year (2024).

Table 6: Predicted Background Pollutant Concentrations

Pollutant	Predicted Background Concentration (µg/m³)	
	2019	2024
NO_x	33.56	28.07
NO_2	22.79	19.39
PM_{10}	13.16	12.80
$PM_{2.5}$	8.54	8.22

As indicated in Table 6, background pollutant concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the relevant AQOs detailed in Table 1.

8

9 https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

4.4 SENSITIVE RECEPTORS

A sensitive receptor is defined as any location which may be affected by changes in air quality as a result of a development. These have been defined for construction dust impacts in the following Sections.

4.4.1. CONSTRUCTION PHASE SENSITIVE RECEPTORS

There are no nationally or European designated ecological receptors within 50m of the Site boundary, or within 50m from a route used by construction vehicles on the public highway (up to 500m from the Site entrance). Therefore, the risk of dust effects at a nationally or European designated ecological receptor site from construction impacts have not been considered further in this assessment.

Human receptors sensitive to potential dust impacts during, earthworks and construction were identified from a desk-top study of the area up to 350m from the Proposed Development boundary. These are summarised in Table 7.

Table 7: Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors
Less than 20	More than 100
20 – 50	More than 100
50 – 100	More than 100
100 – 350	More than 100

Reference should be made to Figure 3 within Appendix B for a graphical representation of earthworks, and construction dust buffer zones.

Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of the area up to 50m from the road network within 500m of the site access route. These are summarised in Table 8. The exact construction vehicle access routes were not available for the purpose of this assessment as they will depend on sourcing of materials. This is likely to be decided by the contractor. However, it was assumed that construction traffic would access the Proposed Development via Great Jackson Street, to ensure a worst case trackout assessment is undertaken.

Table 8: Trackout Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors
Less than 20	More than 100
20 – 50	More than 100

Reference should be made to Figure 4 within Appendix B for a graphical representation of trackout dust buffer zones.

A number of additional factors have been considered when determining the sensitivity of the surrounding area. These are summarised in Table 9.

Table 9: Additional Area Sensitivity Factors

Guidance	Comment
Whether there is any history of dust generating activities in the area	The Site is located within a residential area undergoing significant regeneration. As such, historical dust generation may have occurred as a result of windblown

Guidance	Comment
	emissions from regeneration, specifically as a result of construction phase processes
The likelihood of concurrent dust generating activity on nearby sites.	A review of the MCC Planning Portal indicated that there are several planning applications within 500m of the Proposed Development. As such, there is potential for concurrent dust generation should the construction phases of the aforementioned developments overlap.
Pre-existing screening between the source and the receptors	There is no dense vegetation present along the development boundaries. Hence, there is no level of natural protective screening in any directions.
Conclusions drawn from analysing local meteorological data which accurately represent the area: and if relevant the season during which works will take place	There is sparse vegetation present along all boundaries of The Site. As such, pre-existing protective screening is limited
Conclusions drawn from local topography	The wind direction is predominantly from the south of the Proposed Development, as shown in Figure 6.4. As such, properties to the north would be most affected by dust emissions
Duration of the potential impact, as a receptor may become more sensitive over time	The topography of the area appears to be predominantly flat. As such, there are no constraints to dust dispersion
Any known specific receptor sensitivities which go beyond the classifications given in the document.	The Crown Street Phase 2 development is anticipated for full completion during 2024, additionally the adjacent Crown Street Phase A and B situated immediately north, is currently under construction. Given the duration and overlapping of nearby construction phases receptor sensitivity could increase over time.

4.4.2. OPERATIONAL PHASE SENSITIVE RECEPTORS

A desk-top study was undertaken in order to identify any sensitive receptor locations in the vicinity of the site that require specific consideration during the assessment and are summarised Table 10.

Table 10: Existing Sensitive Human Receptors

Potential Impact		NGR (m)		Height (m)
		X	Y	
R1	Residential - Chester Road	382654	397099	1.5
R2	Residential - Chester Road	382887	397207	1.5
R3	Residential - Chester Road	382936	397225	4.5
R4	Residential - Chester Road	382854	397237	1.5
R5	Residential - Chester Road	382912	397297	1.5
R6	Residential - Egerton Street	382973	397347	4.5
R7	Residential - Egerton Street	382912	397396	5.5
R8	Residential - Egerton Street	382786	397441	0.5
R9	Residential - Mancunian Way	383251	397127	1.5
R10	Residential - Chester Road	383216	397424	1.5
R11	Residential - City Road East	383502	397254	5.5
R12	Residential - City Road East	383556	397281	3

Potential Impact		NGR (m)		Height (m)
		X	Y	
R13	Residential - City Road East	383588	397372	1.5
R14	Residential - Albion Street	383610	397476	4.5
R15	Residential - Albion Street	383652	397543	4.5
R16	Residential - Old Deansgate	383357	397450	2.5
R17	Residential - Bridgewater Viaduct	383306	397447	0.5
R18	Residential – Deansgate Square	383317	397401	1.5
R19	Residential - Deansgate Square	383341	397415	1.5
R20	Residential - Whitworth Street East	383715	397519	4
R21	Commercial - Great Jackson Street	383281	397197	1.5
R22	Commercial - Great Jackson Street	383360	397176	1.5
R23	Commercial - Egerton Street	382865	397438	1.5
R24	Commercial - Gaddum House	383237	397313	1.5
R25	Residential – Crown Street Phase 1	383100	397287	1.7

Receptors modelled at 1.5m to represent the average UK “breathing height” above ground level. Reference should be made to Figure 6 within Appendix B for a graphical representation of operational phase emission sensitive human receptor locations.

5 ASSESSMENT

5.1 CONSTRUCTION PHASE ASSESSMENT

5.1.1. STEP 1 – SCREENING

The desk-study detailed in Section 4.4.1 identified a number of receptors with a high classification of sensitivity within 350m of the site boundary, and within 50m of the anticipated trackout routes. As such, a detailed assessment of potential dust impacts was required, and summarised in the below sections.

5.1.2. STEP 2A – MAGNITUDE

The scale and nature of the works was determined to assess the magnitude of dust arising from each construction phase activity. The determination of magnitude was based upon the criteria detailed in Appendix F with the outcome of Step 2A is summarised below in Table 11.

Demolition

There is no scope for demolition in order to prepare the site for construction. Subsequently, this aspect of the construction phase dust risk assessment has not been considered further.

Earthworks

The Proposed Development site is estimated to cover an area of approximately 11,000m^2. The magnitude of potential dust emissions related to earthwork activities is therefore considered large.

Construction

The proposals comprise the construction of a new three story underground car park. Given the scale of the Proposed Development the total building and infrastructure volume is between 25,000 and 100,000m^3. The magnitude of potential dust emissions related to construction activities is therefore considered medium.

Trackout

Information on the number of HDV trips to be generated during the construction phase of the Proposed Development was not available at the time of assessment. Similarly, the surface material and unpaved road length was not known at this stage of the project. Based on the site area, it is anticipated that the unpaved road length is likely to be between 50 and 100m. The magnitude of potential dust emissions from trackout is therefore considered medium.

Table 11: Dust Emission Magnitude

Magnitude of Activities		
Earthworks	**Construction**	**Trackout**
Large	Medium	Medium

5.1.3. STEP 2B – SENSITIVITY

The next step (Step 2B) is to determine the sensitivity of the surrounding area, based on general principles such as amenity and aesthetics, as well as human exposure sensitivity.

Dust Soiling

As shown in Section 4.4.1, the desk top study indicated are approximately more than 100 sensitive receptors within 350m of the Proposed Development boundary and more than 100 within 50m of the anticipated trackout routes.

Based on the assessment criteria detailed in Appendix F, the sensitivity of the receiving environment to potential dust soiling impacts was considered to be high for all construction phase activities. This is because the site is situated in a predominantly residential area and the people or property would reasonably be expected to be present here for extended periods of time.

Human Health

The annual mean concentration of PM_{10} is 13.16µg/m^3 as detailed in Section 4. Based on the receptor counts provided above, the area is considered to be of medium sensitivity for all construction phase activities.

The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria detailed in Appendix F is summarised in Table 12.

Table 12: Sensitivity of the Surrounding Area

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction	Trackout
Dust Soiling	High	High	High
Human Health	Medium	Medium	Medium

5.1.4. STEP 2C – RISK

Both the magnitude and sensitivity factors are combined in Step 2C to determine the risk of dust impacts without the application of best practice mitigation measures.

It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on a worst-case scenario of works being undertaken at the site boundary closest to each sensitive area. Therefore, actual risk is likely to be lower than that predicted during the majority of the construction phase. A summary of the risk from each dust generating activity is provided in Table 13.

Table 13: Summary of Potential Unmitigated Dust Risks

Potential Impact	Risk		
	Earthworks	Construction	Trackout
Dust Soiling	High	Medium	Medium
Human Health	Medium	Medium	Low

5.1.5. STEP 3 – MITIGATION

The IAQM guidance[3] provides a number of potential mitigation measures to reduce impacts during the construction phase. These measures have been adapted for the Proposed Development site as summarised in Table 14.

Table 14: Fugitive Dust Mitigation Measures

Issue	Control Measure
Communications	• Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.

Issue	Control Measure
	• Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager. • Display the head or regional office contact information • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.
Site Management	• Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. • Make the complaints log available to the local authority when asked • Record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book. • Hold regular liaison meetings with other high-risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.
Monitoring	• Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary, with cleaning to be provided if necessary. • Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked • Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. • Agree dust deposition, dust flux, or real-time PM10 continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.
Preparing & Maintaining Site	• Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. • Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site. • Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive time period • Avoid site runoff of water or mud • Keep site fencing, barriers and scaffolding clean using wet methods. • Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below. • Cover, seed or fence stockpiles to prevent wind whipping.

Issue	Control Measure
Operating Vehicle/Machinery & Sustainable Travel	• Ensure all vehicles switch off engines when stationary - no idling vehicles. • Avoid the use of diesel- or petrol-powered powered generators and use mains electricity or battery powered equipment where practicable. • Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un- surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate) • Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials • Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Use enclosed chutes and conveyors and covered skips. • Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate. • Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Waste Management	• Avoid bonfires and burning of waste materials
Earthworks & Construction	• Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable • Only remove the cover in small areas during work and not all at once • Avoid scabbling (roughening of concrete surfaces) if possible • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place. • Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery. • For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
Trackout	• Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use. • Avoid dry sweeping of large areas. • Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.

Issue	Control Measure
	• Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. • Record all inspections of haul routes and any subsequent action in a site log book. • Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned. • Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). • Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits. • Access gates to be located at least 10 m from receptors where possible.

5.1.6. STEP 4 – RESIDUAL IMPACTS

Assuming the relevant mitigation measures outlined in Table 14 are implemented, the residual effect from all dust generating activities is predicted to be negligible and therefore **not significant** in accordance with the IAQM guidance[3].

5.2 OPERATIONAL PHASE ASSESSMENT

The following assessment has been undertaken in accordance with the methodology detailed in Section 3.2.

Electric Vehicle Charging infrastructure will be installed at 39 of the 389 planned car parking spaces on site. Of the 39 electric vehicle charging spaces, half will be 7kw and half will be 22kw providing faster charging. This has not been accounted for within the following impact assessment to ensure a worst case scenario.

5.2.1. FUTURE EXPOSURE

Annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations were predicted across the Proposed Development for the 2024 DS scenario at a height of 1.5m to represent exposure across the ground floor level, as shown in Figures 7 to 10 within Appendix B.

Background NO_2 PM_{10} and $PM_{2.5}$ levels are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at heights above ground floor level are considered acceptable in regards to future exposure and have not been assessed further.

The public park users are not considered subject to long-term exposure in accordance with LAQM (TG16)[2]. Subsequently, consideration of annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations is not required across phase D itself. However, for completeness this has been considered within the assessment.

Nitrogen Dioxide (NO_2)

Predicted annual mean NO_2 concentrations across Phase D during the DS scenario are summarised in Table 15.

Table 15: Modelling Results - Annual Mean NO_2 at Proposed Development

Floor Level	Predicted 2024 Annual Mean NO_2 Concentration (µg/m³)
Ground (1.5m)	26.4 – 31.2

The predicted concentrations shown in Table 15 indicate that there were no exceedances of the AQO across the Proposed Development. As such, it is considered that annual mean NO_2 levels at the Proposed Development site should not be viewed as a constraint to development.

Predictions of 1-hour NO_2 concentrations were not produced as part of the dispersion modelling assessment. LAQM.(TG16)[2] states if annual mean NO_2 concentrations are below 60µg/m^3 then it is unlikely that the 1-hour AQO will be exceeded. As such, based on the results in Table 15, it is not predicted that on-site concentrations will exceed the 1-hour mean AQO for NO_2.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for residential use without the implementation of mitigation techniques to protect future site users from elevated NO_2 concentrations.

1-Hour Mean Nitrogen Dioxide (NO_2)

Predicted 1-hour mean NO_2 concentrations (presented as the 99.79thpercentile (%ile) or the 18th highest value of the year) across the Proposed Development site during the DS scenario are summarised in Table 16.

Table 16: Modelling Results – 1-Hour Mean NO_2 at Proposed Sensitive Use

Floor Level	Predicted 2024 Hourly 99.79th %ile NO_2 Concentration Range (µg/m^3)
Ground (1.5m)	42.4 – 43.4

The predicted concentrations shown in Table 16 indicate that there were no predicted exceedances of the 1-hour AQO (200 µg/m^3) across the Proposed Development (Phase D).

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for the proposed end use without the implementation of mitigation techniques to protect future site users from elevated 1-hour mean NO_2 concentrations.

Therefore, it is considered that both annual and 1-hour mean NO_2 concentrations should not be viewed as a constraint to development.

Particulate Matter (PM_{10} & $PM_{2.5}$)

Predicted annual mean PM_{10} and $PM_{2.5}$ concentrations across the Proposed Development site during the DS scenario are summarised in Table 17.

Table 17: Modelling Results - Annual Mean PM_{10} and $PM_{2.5}$ at Proposed Development

Floor Level	Predicted 2024 Annual Mean Concentration (µg/m^3)	
	PM_{10}	$PM_{2.5}$
Ground (1.5m)	14.8 – 16.2	9.3 – 10.2

The predicted concentrations shown in Table 17 indicate that there were no exceedances of the annual mean AQOs for PM_{10} or $PM_{2.5}$ throughout the modelling area. As such, it is considered that annual mean PM_{10} or $PM_{2.5}$ levels at the Proposed Development site should not be viewed as a constraint to development.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for proposed end use without the implementation of mitigation techniques to protect future site users from elevated PM_{10} and $PM_{2.5}$ concentrations.

5.2.2. IMPACT ASSESSMENT - PREDICTED CONCENTRATIONS AT EXISTING SENSITIVE USE

A dispersion modelling assessment was undertaken in order to quantify potential changes in pollutant concentrations at sensitive locations in the vicinity of the site based on the anticipated AADT trip generation.

Predicted impacts on annual mean NO_2 concentrations as a result of operational phase exhaust emissions were predicted to be **negligible** at 24 sensitive receptor locations within the vicinity of the site and **slight** at 1 sensitive receptor locations within the vicinity of the site.

Predicted impacts on annual mean PM_{10} and $PM_{2.5}$ concentrations as a result of operational phase exhaust emissions were predicted to be **negligible** at all 25 sensitive receptor locations within the vicinity of the site.

The overall significance of potential impacts was determined to be **not significant** in accordance with the EPUK and IAQM guidance. The use of robust assumptions, in the form of worse-case road vehicle emission factors, was considered to provide sufficient results confidence for an assessment of this nature.

Full assessment results and commentary can be found in Appendix D, further discussion on the overall impact significance is provided in Table 18.

5.2.3. IMPACT SIGNIFICANCE

The overall significance of operational phase road traffic emission impacts for 2024 was determined as not significant. This was based on the predicted impacts at discrete receptor locations and the considerations outlined in Section 5.2. Further justifications are provided in Table 18.

Table 18: Overall Road Emissions Impact Significance

Guidance	Comment
Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance	Impacts on annual mean NO_2 concentrations were predicted to be **negligible** at24 sensitive receptors and **slight** at 1 sensitive receptor. Critically the slight impact remained below the AQO. Impacts on annual mean PM_{10} and $PM_{2.5}$ concentrations were predicted to be **negligible** at 25 sensitive receptors. The overall balance on air quality impacts as a result of the Proposed Development is therefore deemed **not significant**.
Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant	The proposed development will result in one new exposure to pollutant concentrations above the AQOs, this is as a result of a negligible impact to a receptor with a DM concentration at 99.7% of the AQO.
The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors	The change in concentration relative to the AQO was predicted to range from: • 0.21% to 1.03 % for NO_2; • <0.01% to 0.27 % for PM_{10}; and • <0.01% to 0.04 % for $PM_{2.5}$ Resultant impacts were subsequently predicted to be **negligible** at 24 receptor locations and **slight** for NO_2 at 1 receptor location.
Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a substantial increase or decrease	There were no exceedances of the annual mean AQO for PM_{10} and $PM_{2.5}$ at any location within the modelling extent.
The extent to which an objective is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3	NO_2 concentrations exceeded 41µg/m^3 at a one location in both the DM and DS scenario. Impacts at this locations are considered negligible. PM_{10} and $PM_{2.5}$ concentrations did not exceed the AQO at any receptor location.

The assessment was undertaken in accordance with the methodology detailed in Section 3.2 and full impact assessment results can be found in Appendix D.

6 MITIGATION MEASURES

Although there is no requirement for mitigation measures in relation to operational phase impacts, the following mitigation measures will be included as part of the development.

- Electric Vehicle Charging infrastructure will be installed at 39 of the 389 planned car parking spaces on site. Of the 39 electric vehicle charging spaces, half will be 7kw and half will be 22kw providing faster charging.
- Free cycle storage spaces will be provided for each residential apartment alongside some external cycle storage spaces. A cycle path will pass from the development to the main cycle network on Chester Road. A cycle user group will initiated to promote the use of cycling infrastructure.
- Parking space will be allocated to an Enterprise operated car club for use by residents of the development.
- Travel information packs will be provided to residents as part of a welcome pack identifying options for sustainable modes of transport.
- A Travel plan co-ordinator will be appointed within the development and co-ordinate car sharing and a notice board for the promotion of car sharing.

7 CONCLUSION

PEC Ltd were commissioned by the Client to undertake an Air Quality Screening Assessment in support of proposed development at Crown Street Phase 2 (Phase D), Manchester

During the construction phase of the Proposed Development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. These were assessed in accordance with the IAQM methodology. Assuming good practice dust control measures are implemented, the residual potential air quality impacts from dust generated by construction, earthworks and trackout activities was predicted to be **not significant**.

Dispersion modelling was undertaken to quantify annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations across the application to assess suitability for proposed use. Modelling results were subsequently verified using MCC local monitoring data.

The dispersion modelling results indicated that annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations across the application site were below the relevant AQOs at the proposed sensitive use. The site is therefore considered suitable for the proposed end-use without the implementation of protective mitigation techniques to protect future amenity.

Predicted impacts on annual mean NO_2 concentrations as a result of operational phase exhaust emissions were predicted to be **negligible** at 24 sensitive receptor locations and **slight** at 1 sensitive receptor location within the vicinity of the site.

Predicted impacts on annual mean PM_{10} and $PM_{2.5}$ concentrations as a result of operational phase exhaust emissions were predicted to be **negligible** at all 25 sensitive receptor locations within the vicinity of the site.

The overall significance of potential impacts was determined to be **not significant** in accordance with the EPUK and IAQM guidance. The use of robust assumptions, in the form of worse-case road vehicle emission factors, was considered to provide sufficient results confidence for an assessment of this nature.

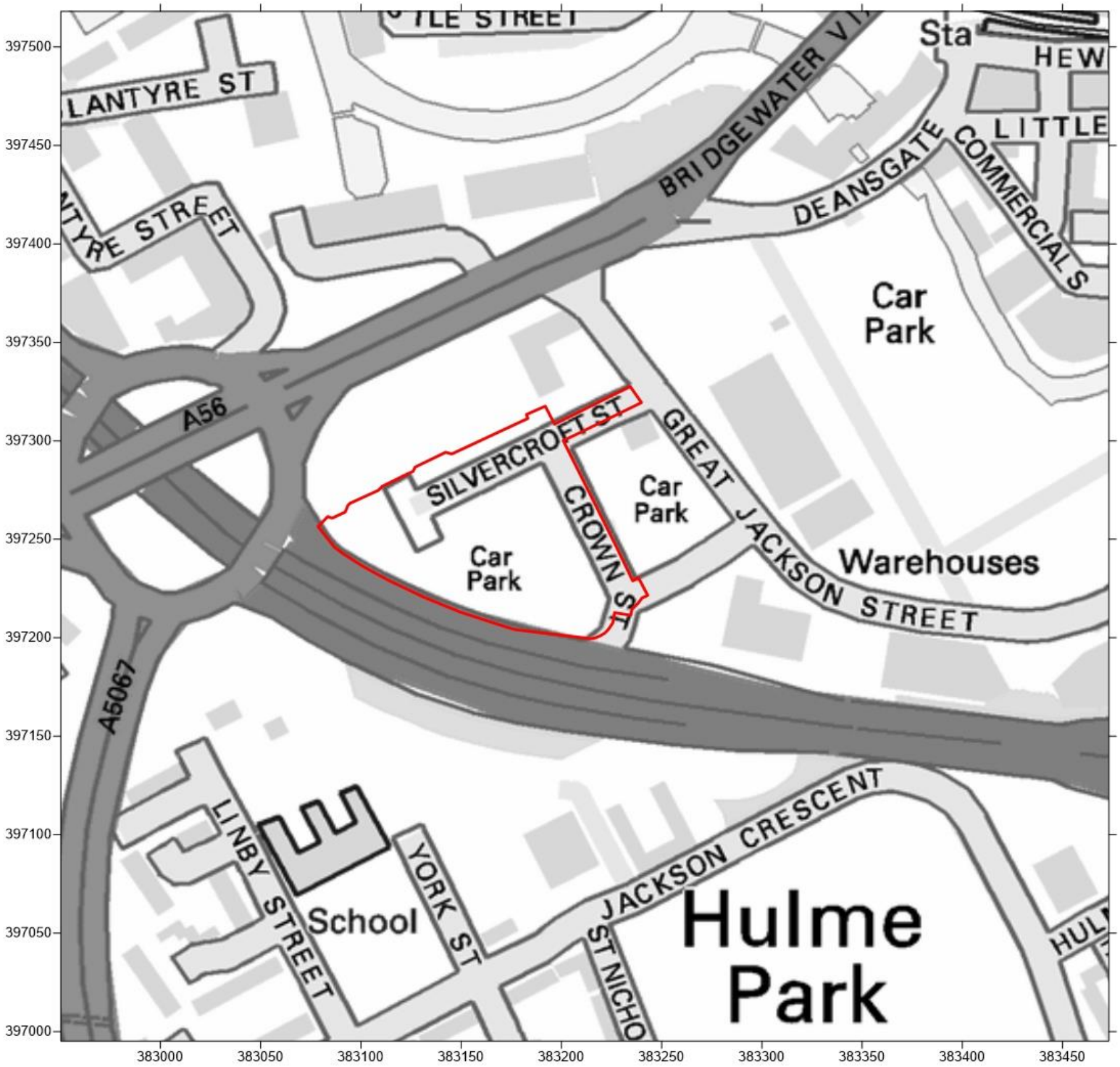
Electric Vehicle Charging infrastructure will be installed at 39 of the 389 planned car parking spaces on site. Of the 39 electric vehicle charging spaces, half will be 7kw and half will be 22kw providing faster charging.

Based on the assessment results the site is considered suitable for the proposed end use and complies with the MCC Local Plan and NPPF.

APPENDIX A – ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DM	Do Minimum
DS	Do Something
DMP	Dust Management Plan
EPUK	Environmental Protection UK
EU	European Union
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LA	Local Authority
LDV	Light Duty Vehicle
NGR	National Grid Reference
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10µm
TEMPRO	Trip End Model Presentation Program
z_0	Roughness Length

APPENDIX B - FIGURES



Legend

Site Boundary

Title

Figure 1

Site Location

Project

Crown Street Phase 2 (Phase D), Manchester

Project Number

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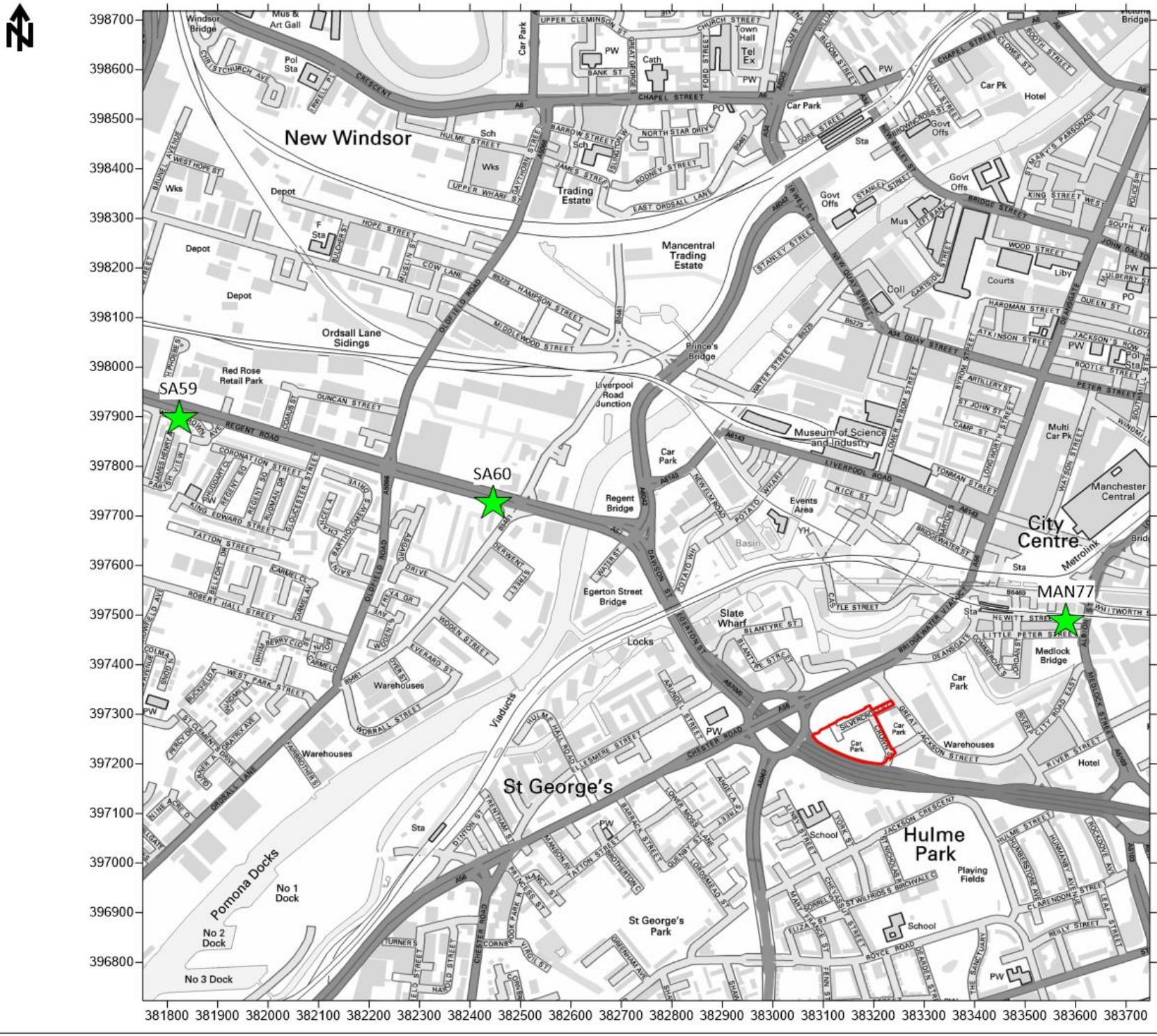

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Site Boundary

Diffusion Tube Monitoring Locations

Title

Figure 2

Diffusion Tube Monitoring Locations

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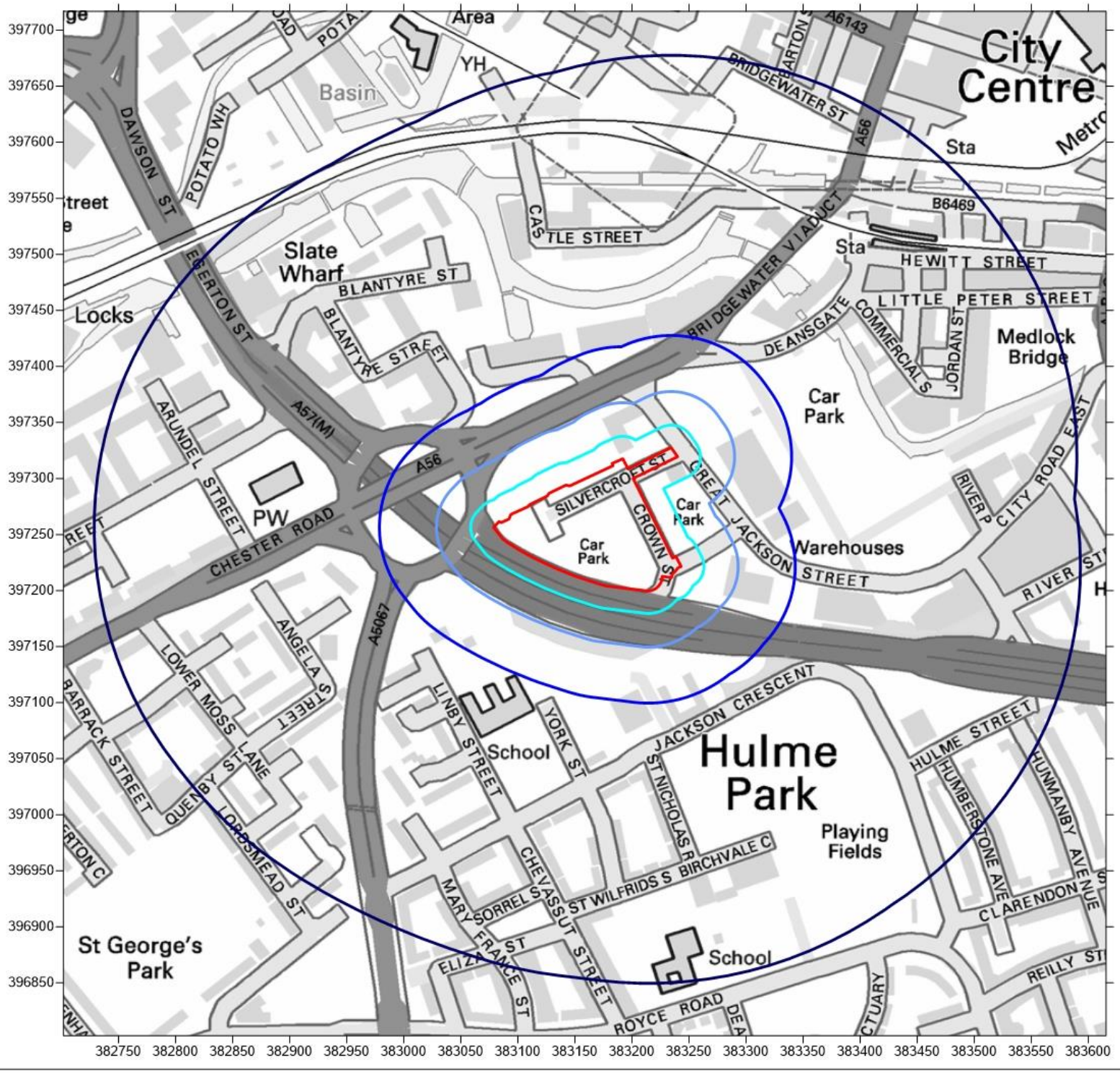

Legend

- Site Boundary
- 20m from Site Boundary
- 50m from Site Boundary
- 100m from Site Boundary
- 350m from Site Boundary

Title

Figure 3

Earthworks and Construction Dust Buffer Zones

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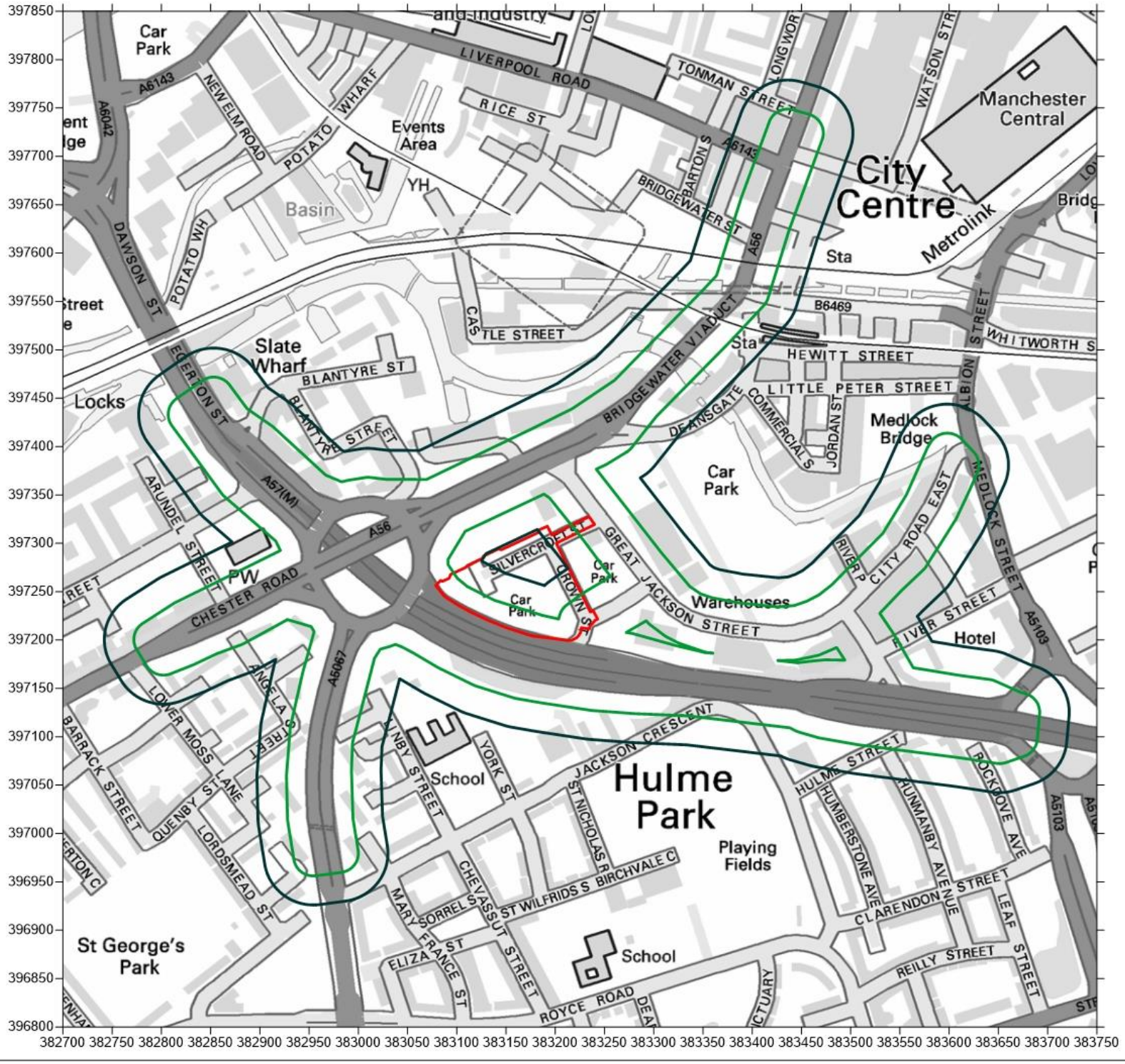

Legend

- Site Boundary
- 20m from Site Access Route
- 50m from Site Access Route

Title

Figure 4

Trackout Dust Buffer Zones

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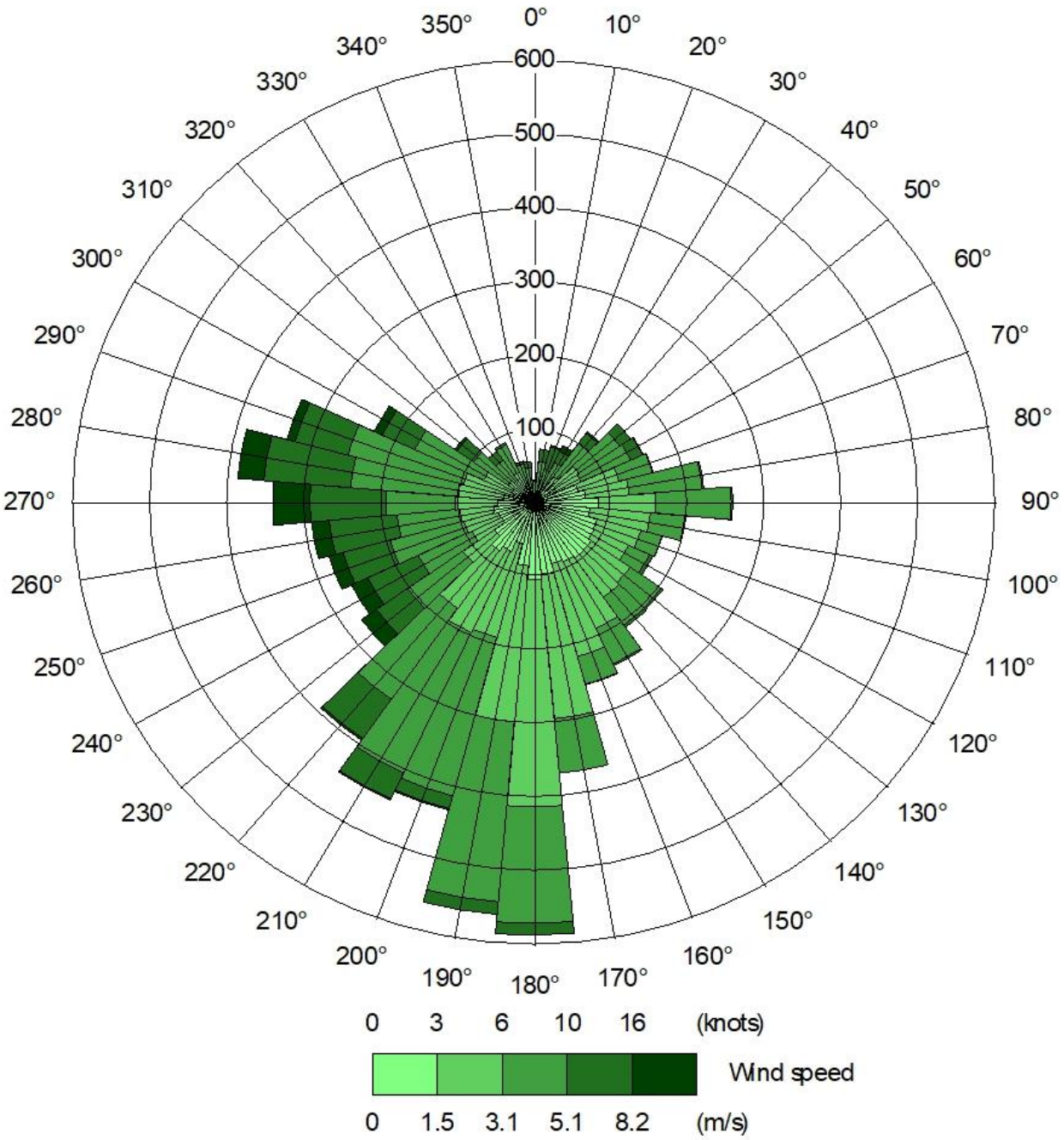

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Figure 5

Wind Rose 2019 Manchester Ringway Meteorological Station

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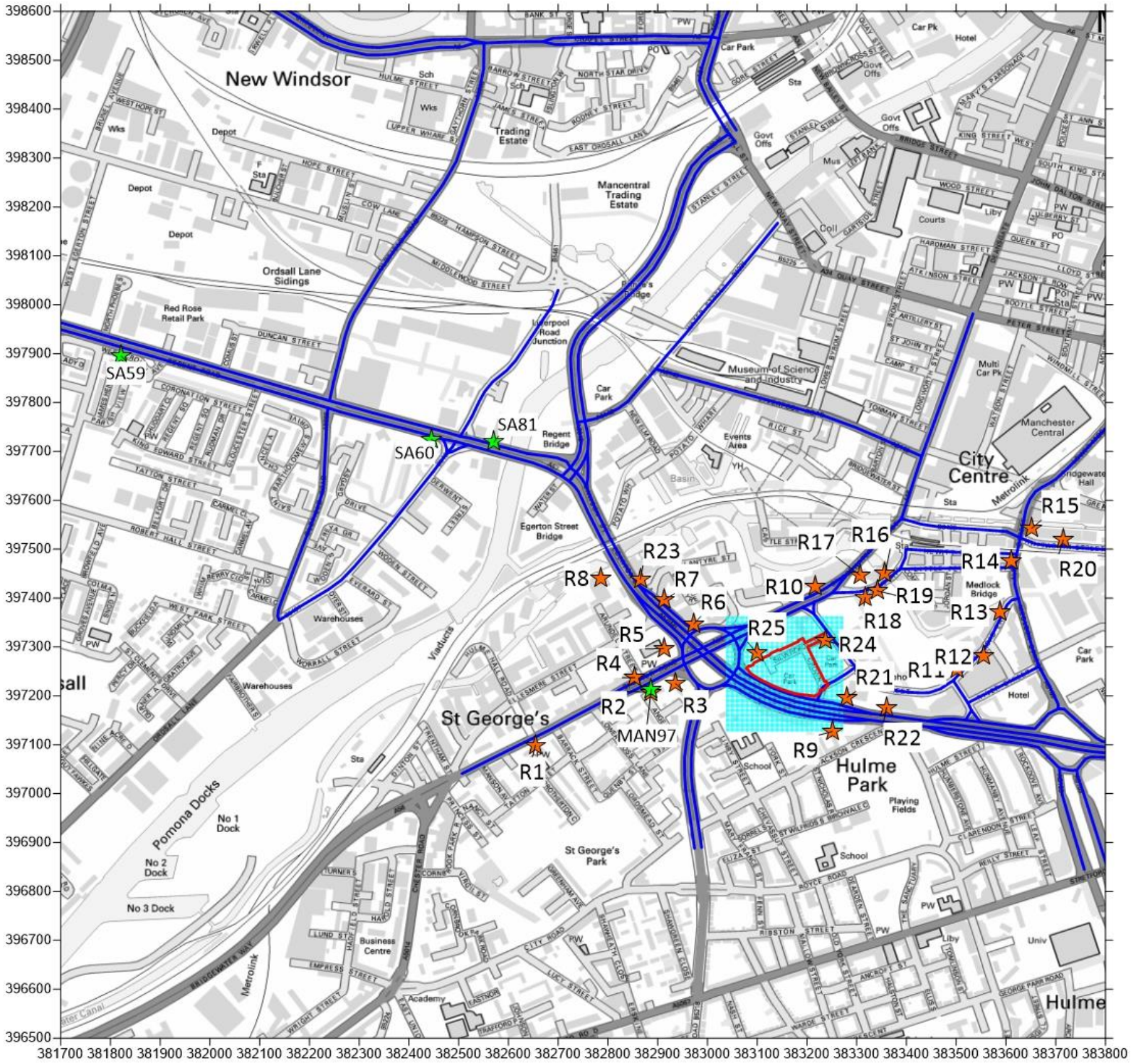

Legend

- Site Boundary
- Modelled Road Link
- Cartesian Grid
- Diffusion Tube Monitoring
- Sensitive Receptor Locations

Title

Figure 6

ADMS-Roads Input

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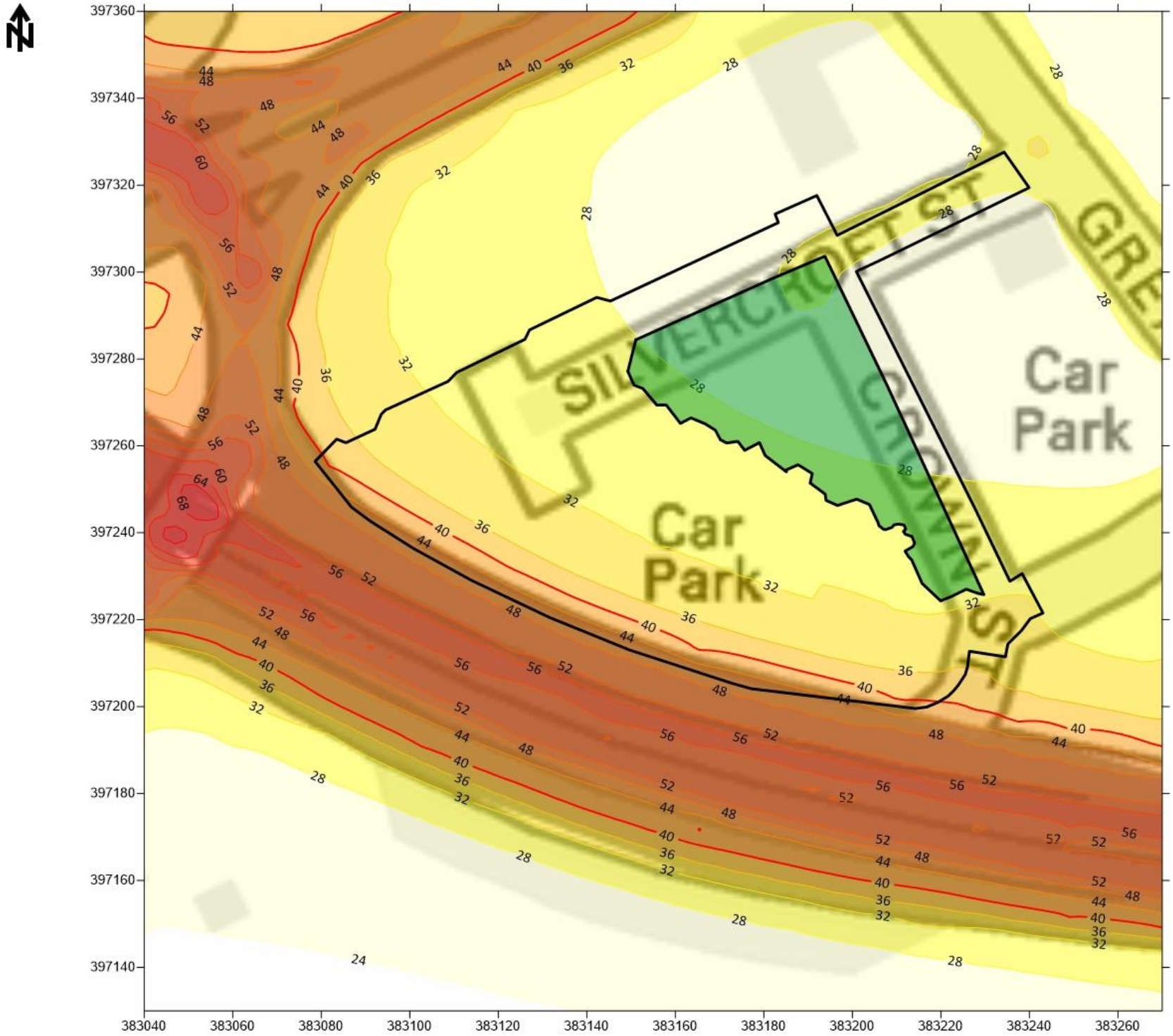

Legend

Site Boundary

Predicted Annual Mean NO_2 Concentration (µg/m³)

68
64
60
56
52
48
44
40
36
32
28
24

Title

Figure 7

Predicted Annual Mean NO_2 Concentrations (µg/m³)

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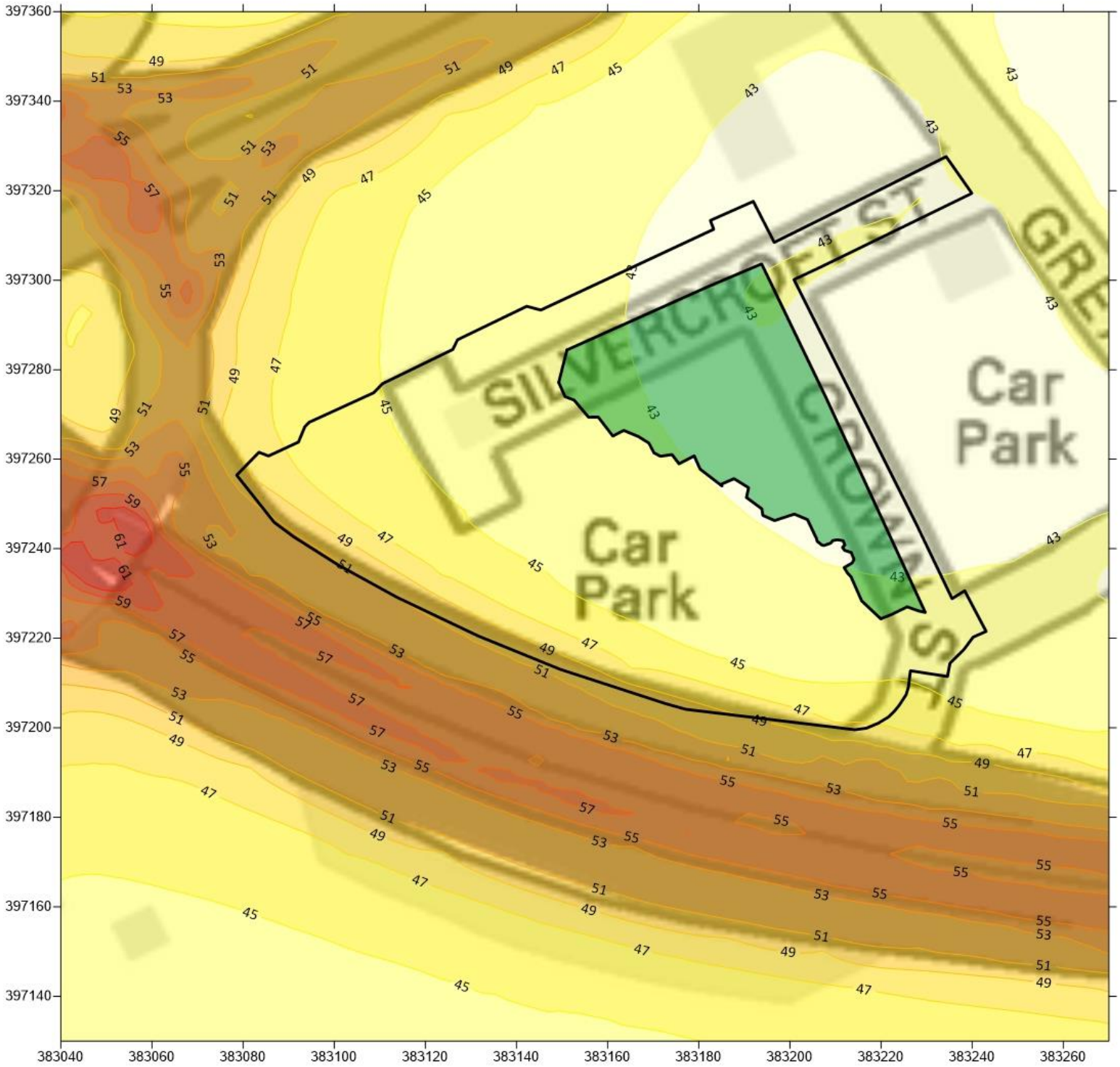

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Site Boundary

Predicted 1-Hour Mean NO_2 Concentration (µg/m³)

63
61
59
57
55
53
51
49
47
45
43
41

Title

Figure 8

Predicted 1-Hour Mean NO_2 Concentrations (µg/m³)

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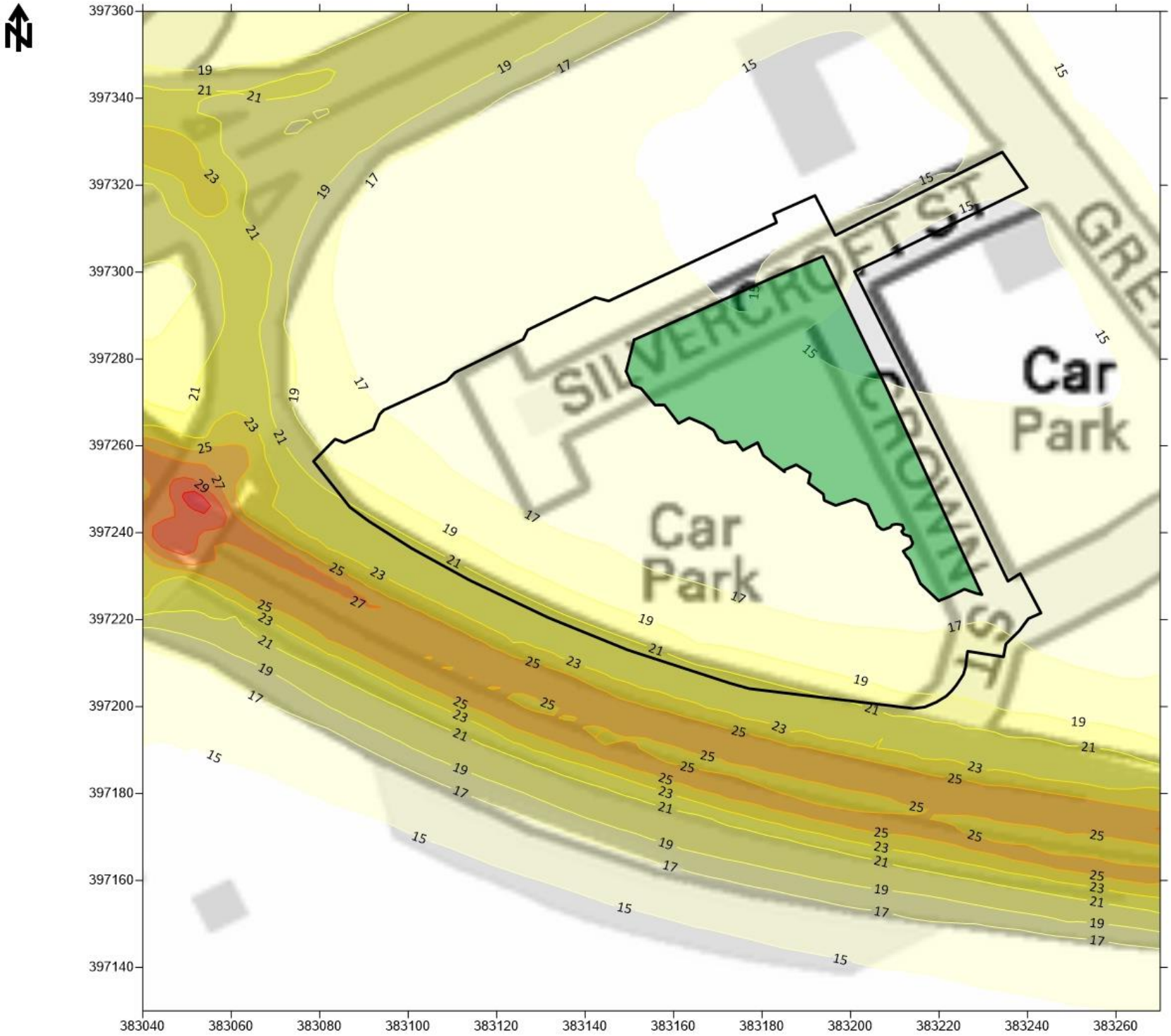

Legend

Site Boundary

Predicted Annual Mean PM_{10} Concentration (µg/m³)

31
29
27
25
23
21
19
17
15

Title

Figure 9

Predicted Annual Mean PM_{10} Concentrations (µg/m³)

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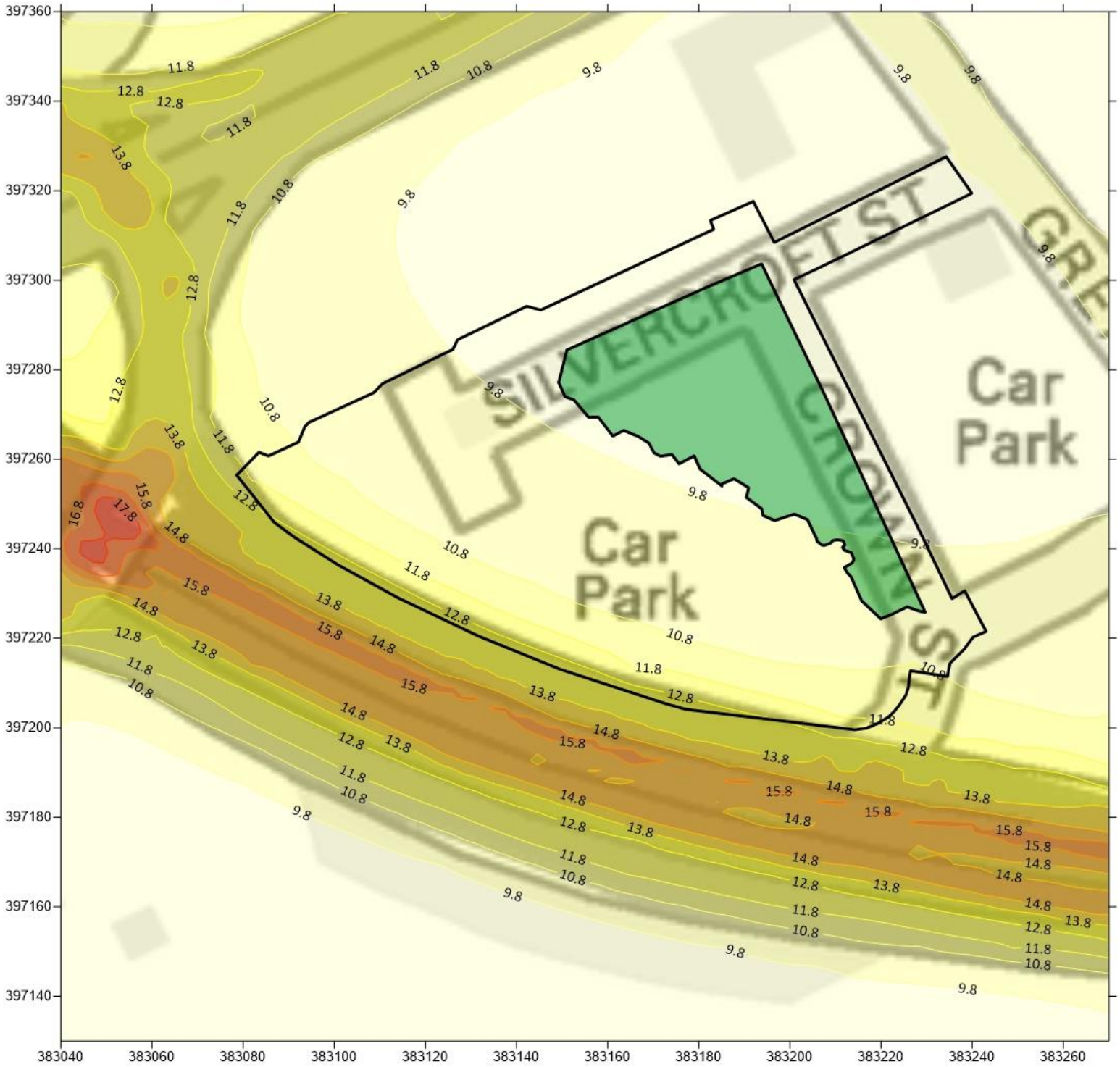

Legend

Site Boundary

Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m³)

18.8
17.8
16.8
15.8
14.8
13.8
12.8
11.8
10.8
9.8
8.8

Title

Figure 10

Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³)

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APPENDIX C – ASSESSMENT INPUTS

The Proposed Development has the potential to introduce future site users to poor air quality. Dispersion modelling using ADMS Roads was therefore undertaken to predict pollutant concentrations across the site to consider site suitability for the proposed end-use.

The assessment was undertaken in accordance with the guidance contained within the DEFRA document LAQM.TG(16)[2] and the EPUK and IAQM guidance[4].

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and
- Monin-Obukhov length.

Assessment Area

Ambient concentrations were predicted over the Proposed Development site and surrounding highway network. One Cartesian grid was included in the model over the area at approximately NGR: 383040, 397130 to 383270, 397360 at height of 1.5m to represent the proposed ground floor level for the 2024 opening year scenario.

Results were subsequently used to produce contour plots within the Surfer software package. Reference should be made to Figure 6 within Appendix A for a graphical representation of the verification inputs and operation phase DS extents, respectively.

Traffic Flow Data

Development flow traffic data and associated network distribution was provided by Curtins, the appointed Transport Consultants for the scheme,

The Dft Matrix web tool enables the user to view and download traffic flows on every link of the A-road and motorway network in Great Britain for the years 1999 to 2019. The DfT matrix is referenced in DEFRA guidance LAQM.TG(16)[2] as being a suitable source of data for air quality assessments and is therefore considered to provide a reasonable representation of traffic flows in the vicinity of the site.

Growth factors provided by the Trip End Model Presentation Program (TEMPRO) software package were utilised to allow for conversion from the obtained 2019 traffic flow to 2024 which was used to represent the opening year scenario. Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

A summary of the traffic data used in the verification scenario is provided in Table C1.

Table C1: 2019 Verification Traffic Data

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L1	A56 (W)	12.5	33,055	3.0	40	Curtins
L2	A56 (W) Slow Down (West)	11.5	16,527	3.0	20	Curtins
L3	A56 (W) Slow Down (East)	9.5	16,527	3.0	10	Curtins
L4	A56 Roundabout	11.3	14,574	3.7	10	SATURN
L5	Regent Road Speed Up(South)	11.4	26,067	4.0	15	Vectos
L6	Regent Road (South)	10.5	33,445	3.1	55	Vectos
L7	A57 (E)	7.0	26,756	3.1	55	Vectos
L8	Regent Road Slow Down (North)	16.4	33,445	3.1	15	Vectos
L9	Regent Road (North)	10.5	33,445	3.1	55	Vectos
L10	A57 (W)	7.3	26,756	3.1	55	Vectos
L11	Regent Road Onslip	6.3	6,689	3.1	32	Vectos
L12	Regent Road Offslip	7.5	6,689	3.1	32	Vectos
L13	A56 Roundabout	16.0	15,320	4.2	12	SATURN
L14	A56 Across Roundabout (East)	7.5	8,264	3.0	32	Curtins
L15	A56 Across Roundabout (West)	7.5	5,837	3.0	32	Curtins
L16	A56 Roundabout	11.0	15,320	4.2	12	SATURN
L17	A56 Roundabout	11.0	17,029	3.6	36	SATURN
L18	A56 roundabout (Manc Way)	11.0	17,029	3.6	36	SATURN
L19	A56 Roundabout	13.0	17,711	2.6	15	SATURN
L20	Chorlton Road Slow Down (North)	6.0	6,060	1.0	15	Curtins
L21	Chorlton Road Slow Down (South)	6.2	6,060	1.0	25	Curtins
L22	A56 Roundabout	12.2	14,574	3.7	15	SATURN
L23	Chorlton Road (North)	6.0	6,060	1.0	40	Curtins
L24	Chorlton Road (South)	6.3	6,060	1.0	40	Curtins
L25	Manc Way East (up to slip roads)	9.5	37,282	4.0	60	Curtins
L26	Manc Way West (up to slip roads)	9.5	37,282	4.0	60	Curtins
L27	Manc Way Onslip	7.3	9,361	4.6	45	SATURN
L28	Manc Way Offslip	7.3	9,992	2.9	50	SATURN
L29	Manc Way Offslip Medlock Street	7.5	10,488	2.1	15	SATURN
L30	Manc Way Onslip Princess Parkway	7.3	10,488	2.1	32	SATURN
L31	Manc Way East (up to University)	8.0	37,282	4.0	55	Curtins
L32	Manc Way West (up to University)	8.0	37,282	4.0	55	Curtins
L33	Princess Parkway	10.7	24,490	2.0	50	Curtins
L34	Princess Parkway	8.2	24,490	2.0	50	Curtins
L35	Princess Parkway Onslip	7.3	12,245	2.0	25	Curtins

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L36	Medlock Street Offslip	7.6	7,541	1.0	25	Curtins
L37	Medlock Street Slow Down	14.5	15,082	1.0	25	Curtins
L38	Medlock Street (River Street to Little Peter Street)	14.6	15,522	1.0	40	Curtins
L39	Albion Street	14.9	15,522	1.0	35	Curtins
L40	Medlock Street Slow Down	14.7	15,522	1.0	15	Curtins
L41	River Street	9.5	1,711	0.0	32	Curtins
L42	City Road East/Great Jackson Street	8.2	2,050	1.0	20	Curtins
L43	City Road East/Great Jackson Street (Street Canyon Section)	17.8	2,050	1.0	35	Curtins
L44	City Road East/Great Jackson Street	8.2	2,050	1.0	35	Curtins
L45	City Road East Slow Down	9.1	3,504	1.0	30	Curtins
L46	Great Jackson Street to Bridgewater Viaduct	5.6	1,752	1.0	15	Curtins
L47	Bridgewater Viaduct to Great Jackson Street	4.5	1,752	1.0	15	Curtins
L48	Garwood Street	8.6	1,226	0.0	32	Curtins
L49	Garwood Street Onslip	5.5	613	0.0	25	Curtins
L50	Garwood Street Offslip	5.5	613	0.0	15	Curtins
L51	Chester Road East (West of Great Jackson Street)	7.3	5,837	3.0	40	Curtins
L52	Chester Road East (West of Great Jackson Street)	7.3	11,674	3.0	40	Curtins
L53	Chester Road East (A56 Roundabout Exit)	3.8	5,837	3.0	20	Curtins
L54	Chester Road East (West of Great Jackson Street)	7.5	5,837	3.0	25	Curtins
L55	Chester Road East (West of Great Jackson Street)	10.8	11,674	3.0	20	Curtins
L56	Chester Road East (A56 Roundabout Approach)	5.6	5,837	3.0	20	Curtins
L57	Chester Road East (Great Jackson Street to Old Deansgate) Eastbound	7.3	11,143	3.0	32	Curtins
L58	Chester Road East (Great Jackson Street to Old Deansgate) Westbound	6.3	11,143	3.0	32	Curtins
L59	A56 Bridgewater Viaduct	10.8	17,704	3.0	32	Curtins
L60	Old Deansgate Slow Down	9.3	4,593	1.0	40	Curtins
L61	Old Deansgate	6.5	4,593	1.0	40	Curtins
L62	Little Peter Street	6.1	1,553	0.0	15	Curtins
L63	Whitworth Street West - Slow Down	11.5	11,369	1.0	15	Curtins
L64	Whitworth Street West	11.5	11,369	1.0	48	Curtins
L65	Whitworth Street East - Slow Down	10.5	8,820	1.0	15	Curtins
L66	Whitworth Street East	10.5	8,820	1.0	48	Curtins
L67	Deansgate	12.0	16,325	3.0	48	Curtins

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L68	Albion Street	15.6	15,448	3.0	35	Curtins
L69	Hewitt Street	5.0	496	0.0	15	Curtins
L70	Hewitt Street	5.1	496	0.0	30	Curtins
L71	Melborne Street	6.5	127	0.0	32	Curtins
L72	Regent Road (West) Slow	11.1	33,445	3.5	15	Vectos
L73	Regent Road (West) Slow	10.2	26,067	4.0	20	Vectos
L74	Regent Road (West) Slow	7.3	26,067	4.0	20	Vectos
L75	Regent Road (East) Slow	19.0	26,067	4.0	15	Vectos
L76	Regent Road (East) Slow	9.8	26,067	4.0	15	Vectos
L77	Regent Road (East) Slow	9.8	26,067	4.0	15	Vectos
L78	Regent Road (West) Slow	7.0	26,067	4.0	32	Vectos
L79	Regent Road (West) Slow	10.0	26,067	4.0	15	Vectos
L80	Regent Road (East) Slow	7.2	26,067	4.0	32	Vectos
L81	Regent Road (East) Slow	7.3	26,067	4.0	15	Vectos
L82	Regent Road (West) Speed Up	7.1	26,067	4.0	15	Vectos
L83	Regent Road (West)	7.5	26,067	4.0	32	Vectos
L84	Regent Road (East) Slow Down	9.5	26,067	4.0	15	Vectos
L85	Regent Road (East)	7.5	26,067	4.0	35	Vectos
L86	Liverpool Road Slow Down	10.3	5,551	2.1	15	DfT
L87	Water Street/Liverpool Street	8.2	5,551	2.1	40	Vectos
L88	Water Street Slow Down	15.6	6,375	2.0	15	Vectos
L89	Trinity Way Northbound (South of Plot C Access)	8.3	13,066	3.1	20	Vectos
L90	Trinity Way Northbound (North of Plot C Access)	7.2	11,682	3.1	40	Vectos
L91	Trinity Way Southbound (North of Plot C Access)	8.3	11,682	3.1	20	Vectos
L92	Trinity Way Southbound (South of Plot C Access)	7.9	13,066	3.1	40	Vectos
L93	Trinity Way onto Regent Road	10.8	6,533	3.1	15	Vectos
L94	Trinity Way onto Egerton Street	7.1	6,533	3.1	15	Vectos
L95	Oldfield Road (North) Slow Down	13.1	9,755	2.3	15	DfT
L96	Oldfield Road (North)	9.9	9,755	2.3	40	DfT
L97	Oldfield Road (South) Slow Down	12.4	7,085	2.7	15	DfT
L98	Oldfield Road (South)	8.2	7,085	2.7	40	DfT
L99	Ordsall Lane (South)	8.7	11,421	1.8	32	DfT
L100	Ordsall Lane (South) Slow Down	13.2	11,421	1.8	10	DfT
L101	Regent Road onto Ordsall Lane	4.0	3,807	1.8	10	DfT
L102	Ordsall Lane onto Regent Road	4.1	3,807	1.8	10	DfT

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L103	Ordsall Lane/Regent Road Junction	15.0	3,807	1.8	10	DfT
L104	Ordsall Lane (North) Slow Down	18.3	9,083	1.8	10	DfT
L105	Ordsall Lane (North)	10.3	9,083	1.8	32	DfT
L106	A34 Irwell Street - South of Chapel Street - Northbound	7.7	15,171	2.7	25	DfT
L107	A34 Irwell Street - South of Chapel Street (Junction Slowdown) Northbound	11.2	15,171	2.7	15	DfT
L108	Trinity Way Northbound - Chapel Street Junction	9.1	15,171	2.7	40	DfT
L109	Trinity Way Northbound - Between New Bridge Street and Bloom Street	8.2	15,171	2.7	40	DfT
L110	A34 Irwell Street - South of Chapel Street - Southbound (Junction Slowdown)	7.8	15,171	2.7	15	DfT
L111	A34 Irwell Street - South of Chapel Street - Southbound	6.7	15,171	2.7	25	DfT
L112	Trinity Way Southbound - Chapel Street Junction	9.6	15,171	2.7	40	DfT
L113	Trinity Way Southbound - Between New Bridge Street and Bloom Street	8.0	15,171	2.7	40	DfT
L114	A6 Chapel Street Eastbound (Junction Slowdown) - West of A34	8.9	8,713	9.4	15	DfT
L115	A6 Chapel Street Eastbound - West of A34	7.0	8,713	9.4	25	DfT
L116	A6 Chapel Street Westbound (Junction Slowdown) - West of A34	8.0	8,713	9.4	15	DfT
L117	A6 Chapel Street Westbound - West of A34	6.9	8,713	9.4	25	DfT
L118	Chapel Street East of Adelphi Street	15.4	17,425	9.4	25	DfT
L119	A6 West of A5066 Westbound, Speed Up	8.0	12,341	7.3	20	DfT
L120	A6 West of A5066 Westbound	7.0	12,341	7.3	40	DfT
L121	A6 Eastbound East of Albion Way	7.7	12,341	7.3	30	DfT
L122	A6 Eastbound East of Albion Way Slowdown at A5066	8.0	12,341	7.3	15	DfT
L123	Water Street (North of Plot D)	7.1	5,551	2.1	20	Vectos

Reference should be made to Figure 6 within Appendix A for a graphical representation of the road link locations used within the verification assessment. The road width and mean vehicle speed shown in Table C1 remained the same for the 2024 scenarios.

A summary of the 2024 traffic data is shown in Table C2.

Table C2: 2024 Traffic Data

Road Link		DM Scenario		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L1	A56 (W)	36,416	3.0	36,416	3.0
L2	A56 (W) Slow Down (West)	18,208	3.0	18,208	3.0

Road Link		DM Scenario		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L3	A56 (W) Slow Down (East)	18,208	3.0	18,208	3.0
L4	A56 Roundabout	15,617	3.8	16,118	3.7
L5	Regent Road Speed Up(South)	26,676	4.0	26,676	4.0
L6	Regent Road (South)	34,335	3.5	34,335	3.5
L7	A57 (E)	27,468	3.5	27,468	3.5
L8	Regent Road Slow Down (North)	34,335	3.5	34,335	3.5
L9	Regent Road (North)	34,335	3.1	34,335	3.1
L10	A57 (W)	27,468	3.0	27,468	3.0
L11	Regent Road Onslip	6,207	3.8	6,867	3.5
L12	Regent Road Offslip	6,399	3.7	6,867	3.5
L13	A56 Roundabout	16,456	4.3	17,187	4.1
L14	A56 Across Roundabout (East)	9,262	3.0	9,262	3.0
L15	A56 Across Roundabout (West)	6,908	3.2	7,395	3.0
L16	A56 Roundabout	16,298	4.3	17,029	4.1
L17	A56 Roundabout	17,603	3.8	18,962	3.5
L18	A56 roundabout (Manc Way)	17,473	3.8	18,832	3.5
L19	A56 Roundabout	19,126	2.6	19,627	2.5
L20	Chorlton Road Slow Down (North)	6,544	1.0	6,596	1.0
L21	Chorlton Road Slow Down (South)	6,544	1.0	6,596	1.0
L22	A56 Roundabout	15,681	3.8	16,182	3.7
L23	Chorlton Road (North)	6,544	1.0	6,596	1.0
L24	Chorlton Road (South)	6,544	1.0	6,596	1.0
L25	Manc Way East (up to slip roads)	40,354	4.0	40,610	4.0
L26	Manc Way West (up to slip roads)	40,610	4.0	40,610	4.0
L27	Manc Way Onslip	9,433	5.1	10,420	4.6
L28	Manc Way Offslip	11,020	2.8	11,020	2.8
L29	Manc Way Offslip Medlock Street	11,542	2.1	11,542	2.1
L30	Manc Way Onslip Princess Parkway	11,542	2.1	11,542	2.1
L31	Manc Way East (up to University)	40,354	4.0	40,610	4.0
L32	Manc Way West (up to University)	40,610	4.0	40,610	4.0
L33	Princess Parkway	26,661	2.0	26,661	2.0
L34	Princess Parkway	26,661	2.0	26,661	2.0
L35	Princess Parkway Onslip	13,331	2.0	13,331	2.0
L36	Medlock Street Offslip	8,108	1.0	8,345	1.0
L37	Medlock Street Slow Down	16,216	1.0	16,690	1.0
L38	Medlock Street (River Street to Little Peter Street)	16,836	1.0	17,310	1.0

Road Link		DM Scenario		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L39	Albion Street	17,252	1.0	17,310	1.0
L40	Medlock Street Slow Down	17,252	1.0	17,310	1.0
L41	River Street	1,894	0.0	1,894	0.0
L42	City Road East/Great Jackson Street	2,181	1.2	2,713	1.0
L43	City Road East/Great Jackson Street (Street Canyon Section)	2,181	1.2	2,713	1.0
L44	City Road East/Great Jackson Street	2,181	1.2	2,713	1.0
L45	City Road East Slow Down	4,740	1.2	5,735	1.0
L46	Great Jackson Street to Bridgewater Viaduct	2,371	1.2	2,868	1.0
L47	Bridgewater Viaduct to Great Jackson Street	2,371	1.2	2,868	1.0
L48	Garwood Street	1,517	0.0	1,517	0.0
L49	Garwood Street Onslip	758	0.0	758	0.0
L50	Garwood Street Offslip	758	0.0	758	0.0
L51	Chester Road East (West of Great Jackson Street)	7,282	3.0	7,282	3.0
L52	Chester Road East (West of Great Jackson Street)	14,564	3.0	14,564	3.0
L53	Chester Road East (A56 Roundabout Exit)	7,282	3.0	7,282	3.0
L54	Chester Road East (West of Great Jackson Street)	6,795	3.2	7,282	3.0
L55	Chester Road East (West of Great Jackson Street)	13,591	3.2	14,564	3.0
L56	Chester Road East (A56 Roundabout Approach)	6,795	3.2	7,282	3.0
L57	Chester Road East (Great Jackson Street to Old Deansgate) Eastbound	13,488	3.0	13,499	3.0
L58	Chester Road East (Great Jackson Street to Old Deansgate) Westbound	13,488	3.0	13,499	3.0
L59	A56 Bridgewater Viaduct	19,463	3.0	19,485	3.0
L60	Old Deansgate Slow Down	7,959	1.0	7,959	1.0
L61	Old Deansgate	7,959	1.0	7,959	1.0
L62	Little Peter Street	1,690	0.0	1,690	0.0
L63	Whitworth Street West - Slow Down	12,370	1.0	12,370	1.0
L64	Whitworth Street West	12,370	1.0	12,370	1.0
L65	Whitworth Street East - Slow Down	9,720	1.0	9,720	1.0
L66	Whitworth Street East	9,720	1.0	9,720	1.0
L67	Deansgate	17,984	3.0	17,984	3.0
L68	Albion Street	16,931	3.0	16,931	3.0
L69	Hewitt Street	540	0.0	540	0.0
L70	Hewitt Street	540	0.0	540	0.0
L71	Melborne Street	1,843	0.0	1,843	0.0
L72	Regent Road (West) Slow	34,335	3.5	34,335	3.5
L73	Regent Road (West) Slow	26,676	4.0	26,676	4.0

Road Link		DM Scenario		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L74	Regent Road (West) Slow	26,676	4.0	26,676	4.0
L75	Regent Road (East) Slow	26,676	4.0	26,676	4.0
L76	Regent Road (East) Slow	26,676	4.0	26,676	4.0
L77	Regent Road (East) Slow	26,676	4.0	26,676	4.0
L78	Regent Road (West) Slow	26,676	4.0	26,676	4.0
L79	Regent Road (West) Slow	26,676	4.0	26,676	4.0
L80	Regent Road (East) Slow	26,676	4.0	26,676	4.0
L81	Regent Road (East) Slow	26,676	4.0	26,676	4.0
L82	Regent Road (West) Speed Up	26,676	4.0	26,676	4.0
L83	Regent Road (West)	26,676	4.0	26,676	4.0
L84	Regent Road (East) Slow Down	26,676	4.0	26,676	4.0
L85	Regent Road (East)	26,676	4.0	26,676	4.0
L86	Liverpool Road Slow Down	7,895	2.4	7,895	2.4
L87	Water Street/Liverpool Street	8,094	2.5	8,094	2.5
L88	Water Street Slow Down	9,160	2.5	9,160	2.5
L89	Trinity Way Northbound (South of Plot C Access)	14,595	3.1	14,595	3.1
L90	Trinity Way Northbound (North of Plot C Access)	11,774	3.1	11,774	3.1
L91	Trinity Way Southbound (North of Plot C Access)	11,774	3.1	11,774	3.1
L92	Trinity Way Southbound (South of Plot C Access)	14,595	3.1	14,595	3.1
L93	Trinity Way onto Regent Road	7,298	3.1	7,298	3.1
L94	Trinity Way onto Egerton Street	7,298	3.1	7,298	3.1
L95	Oldfield Road (North) Slow Down	10,227	2.3	10,227	2.3
L96	Oldfield Road (North)	10,227	2.3	10,227	2.3
L97	Oldfield Road (South) Slow Down	7,428	2.7	7,428	2.7
L98	Oldfield Road (South)	7,428	2.7	7,428	2.7
L99	Ordsall Lane (South)	11,974	1.8	11,974	1.8
L100	Ordsall Lane (South) Slow Down	11,974	1.8	11,974	1.8
L101	Regent Road onto Ordsall Lane	3,991	1.8	3,991	1.8
L102	Ordsall Lane onto Regent Road	3,991	1.8	3,991	1.8
L103	Ordsall Lane/Regent Road Junction	3,991	1.8	3,991	1.8
L104	Ordsall Lane (North) Slow Down	9,522	1.8	9,522	1.8
L105	Ordsall Lane (North)	9,522	1.8	9,522	1.8
L106	A34 Irwell Street - South of Chapel Street - Northbound	16,007	2.7	16,007	2.7
L107	A34 Irwell Street - South of Chapel Street (Junction Slowdown) Northbound	16,007	2.7	16,007	2.7
L108	Trinity Way Northbound - Chapel Street Junction	16,007	2.7	16,007	2.7

Road Link		DM Scenario		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L109	Trinity Way Northbound - Between New Bridge Street and Bloom Street	16,007	2.7	16,007	2.7
L110	A34 Irwell Street - South of Chapel Street - Southbound (Junction Slowdown)	16,007	2.7	16,007	2.7
L111	A34 Irwell Street - South of Chapel Street - Southbound	16,007	2.7	16,007	2.7
L112	Trinity Way Southbound - Chapel Street Junction	16,007	2.7	16,007	2.7
L113	Trinity Way Southbound - Between New Bridge Street and Bloom Street	16,007	2.7	16,007	2.7
L114	A6 Chapel Street Eastbound (Junction Slowdown) - West of A34	9,134	9.4	9,134	9.4
L115	A6 Chapel Street Eastbound - West of A34	9,134	9.4	9,134	9.4
L116	A6 Chapel Street Westbound (Junction Slowdown) - West of A34	9,134	9.4	9,134	9.4
L117	A6 Chapel Street Westbound - West of A34	9,134	9.4	9,134	9.4
L118	Chapel Street East of Adelphi Street	18,269	9.4	18,269	9.4
L119	A6 West of A5066 Westbound, Speed Up	12,939	7.3	12,939	7.3
L120	A6 West of A5066 Westbound	12,939	7.3	12,939	7.3
L121	A6 Eastbound East of Albion Way	12,939	7.3	12,939	7.3
L122	A6 Eastbound East of Albion Way Slowdown at A5066	12,939	7.3	12,939	7.3
L123	Water Street (North of Plot D)	7,895	2.4	7,895	2.4

Reference should be made to Figure 6 within Appendix A for a graphical representation of the road link locations used within the operation phase assessment.

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 11.0) released in November 2021, which incorporates updated COPERT 5.3 vehicle emissions factors for NO_x, PM_{10} and $PM_{2.5}$ and EURO 6 vehicle fleet sub-categories.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the NO_x to NO_2 Calculator (v.8.1) provided by DEFRA, which is the method detailed within LAQM.TG(16)[2].

Meteorological Data

Meteorological data used in this assessment was taken from Manchester Ringway meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive).

Manchester Ringway meteorological station is located at approximate NGR: 381745, 383960 which is approximately 17km south-west of the Proposed Development. Although there is a large distance between the application site and Manchester Ringway the use of this data has prior approval from the Environmental Health Department at MCC and is therefore considered to provide a reasonable representation of conditions at the development site.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 within Appendix A for a wind

rose of utilised meteorological data.

Roughness Length

The specific roughness length (z_0) values used to represent conditions during the verification process, DM/DS scenario, as well as conditions at the Manchester Airport meteorological station are summarised in Table C3.

Table C3: Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification, DM and DS Scenarios	1	Cities, Woodlands
Manchester Airport Met Station	0.3	Agricultural areas (max)

These values of z_0 are considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere within certain urban or rural contexts. The specific length values used to represent conditions during the verification process, DM/DS scenario, as well as conditions at the Manchester Airport Met Station are summarised in Table C4.

Table C4: Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification, DM and DS Scenarios	30	Cities and Large towns
Manchester Airport Met Station	30	Cities and Large towns

This Monin-Obukhov value is considered appropriate for the morphology of the assessment area.

Background Concentrations

The 2024 annual mean background concentrations detailed in Table 6, was used in the dispersion modelling assessment to represent annual mean pollutant levels at the Proposed Development site.

Table C5 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table C5: Predicted Background Pollutant Concentrations for Monitoring Locations

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration (µg/m³)
MAN77	383500, 397500	NO_x	39.95
		NO_2	26.07
SA60, SA81	382500, 397500	NO_x	33.65
		NO_2	22.79

Table C6 displays the predicted background concentrations by DEFRA used in the operational phase assessment for the sensitive receptor locations.

Table C6: Predicted Background Pollutant Concentrations at Sensitive Receptors

Receptor Location	DEFRA Grid Square	Pollutant	2024 Predicted Background Concentration (µg/m³)
R1-R8	382500, 397500	NO_x	26.09
		NO_2	18.35
		PM_{10}	12.43
		$PM_{2.5}$	8.02
R9-R25	383500, 397500	NO_x	31.29
		NO_2	21.29
		PM_{10}	12.69
		$PM_{2.5}$	8.13

2019 background concentrations for each receptor location have been used for the sensitivity analysis. The results of this are detailed in Appendix D.

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2019, using traffic data, meteorological data and monitoring results from this year.

MCC undertakes periodic monitoring of NO_2 concentrations at 4 roadside monitoring location within the assessment extents. The road contribution to total NO_x concentration was calculated from the monitored NO_2 result for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM.TG(16)[2]. The monitored annual mean NO_x concentration and calculated road NO_x concentration are summarised in Table C7.

Table C7: NO_x Concentrations

Site ID	Monitored Road NO_x Concentration (µg/m³)	Modelled Road NO_x Concentration (µg/m³)	% Difference ((Monitored - Modelled)/Monitored)) * 100
MAN97	25.07	14.22	43%
SA59	26.63	12.58	53%
SA60*	34.35	31.45	8%
SA81*	56.62	54.19	4%

*SA60 and SA81 *were not included within the verification process due to suitable correlation with monitored NO_x concentration prior to adjustment..*

According to LAQM.TG(16), no adjustment is necessary where the results of the model all lie within 10% of the monitored

concentrations or provide systematic overpredictions (SA60 and SA81). Subsequently, specific monitors have not been included within the calculation of the NO_x adjustment factor.

The monitored and modelled NOx road contribution concentrations were graphed and the equation of the trend line based on the linear progression through zero was calculated, as shown in Graph 1

This indicated that a verification factor of 1.9183 was required to be applied to all NOx modelling results, showing the model overestimated pollutant concentrations throughout the assessment extents.

An adjustment factor of 1 has been applied where modelled concentrations are observed within 10% of monitored NOx concentrations, or in cases where systematic overpredictions occur. This method ensures that over adjustment is avoided at locations where the initial modelling provides suitable correlation to monitored concentrations.

Graph 1 is provided below.

Graph 1 - Verification Adjustment Factor

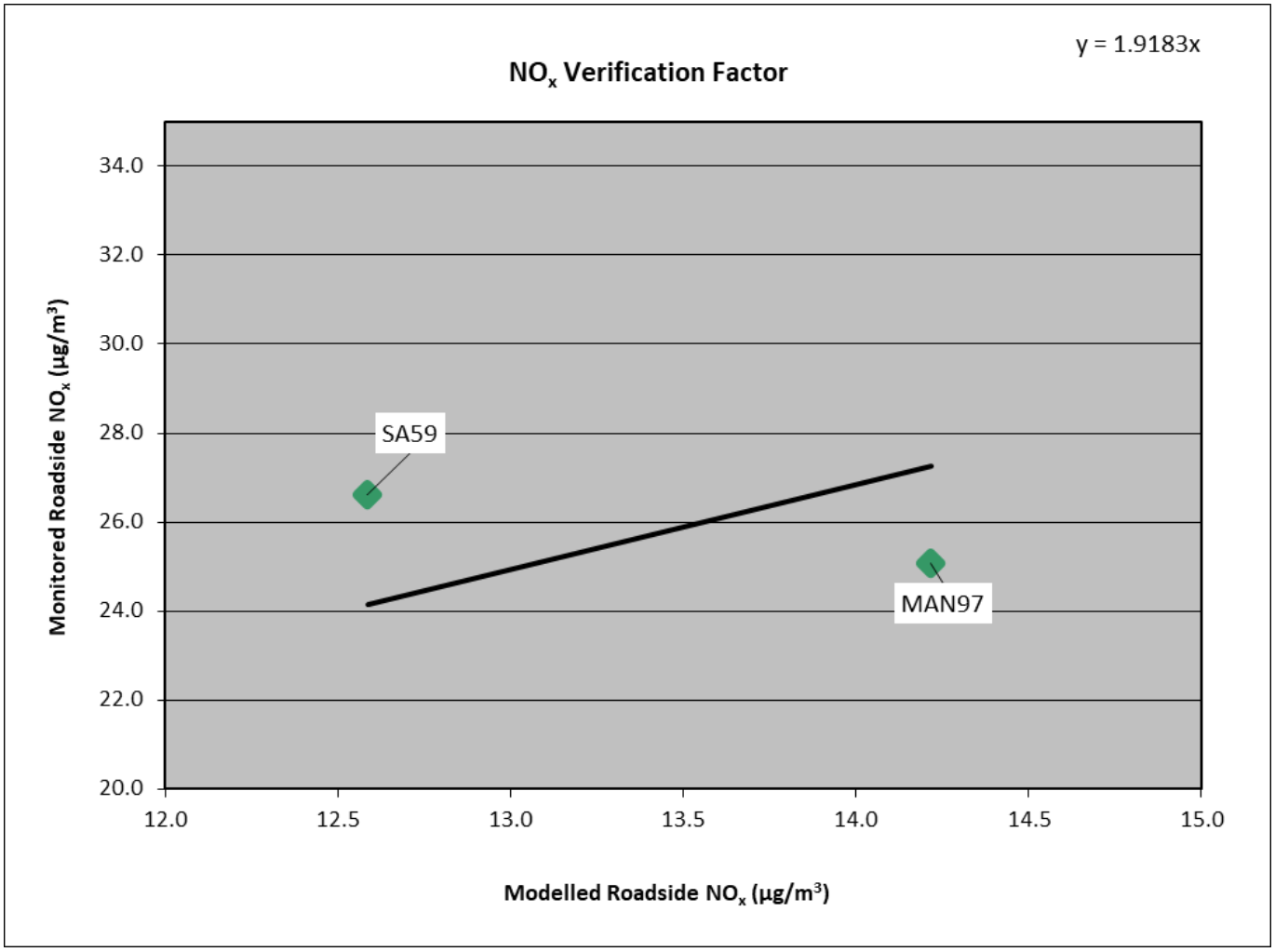


Table C8 presents the monitored annual mean NO_2 concentrations and the adjusted modelled total NO_2 concentration based on the above verification factor. Exceedances of the annual mean NO_2 AQO are highlighted in **bold**.

Table C8: NO_2 Concentrations

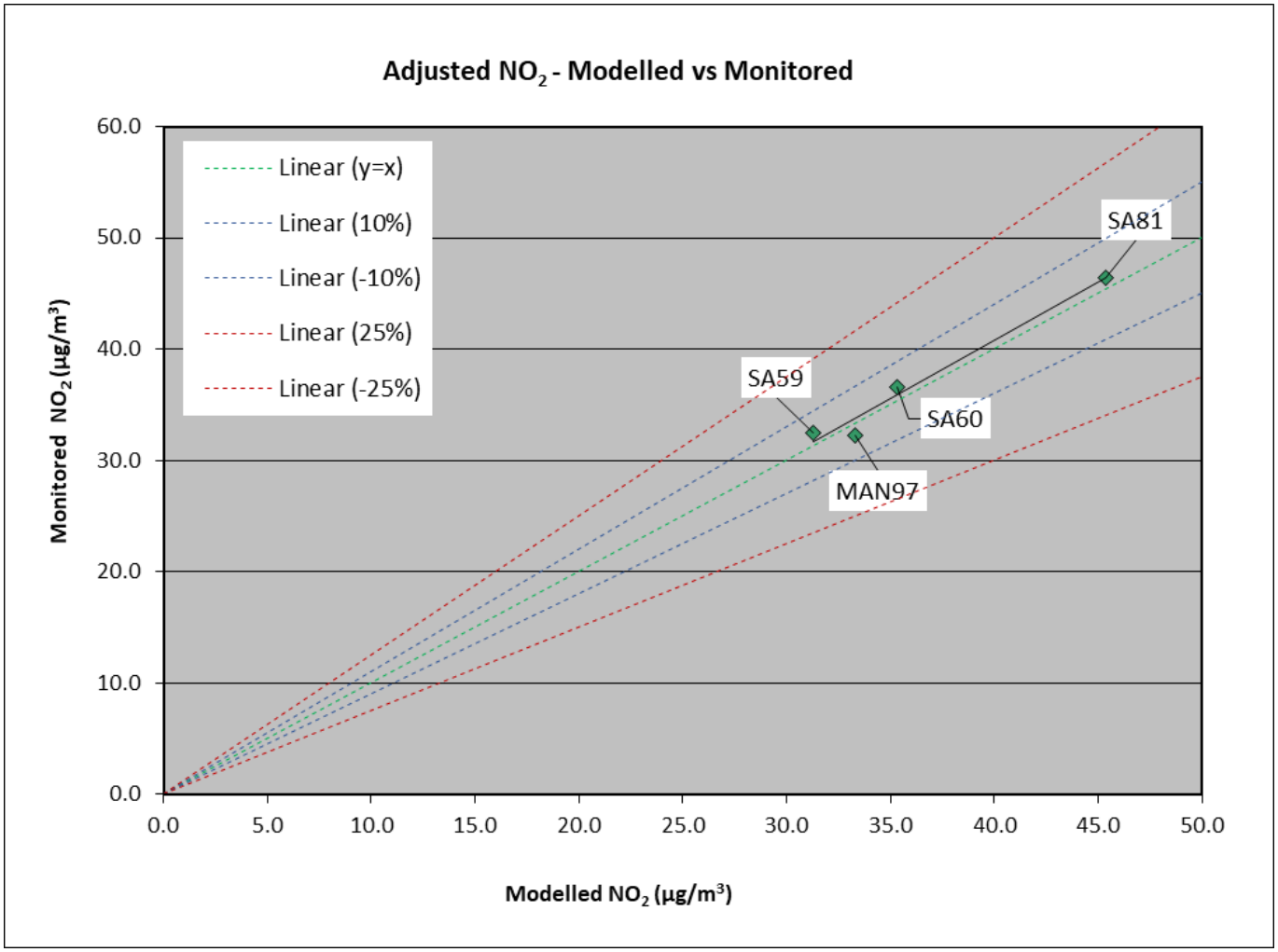
Site ID	Monitored Total NO_2 Concentration (µg/m³)	Adjusted Modelled Total NO_2 Concentration (µg/m³)	% Difference ((Monitored - Modelled)/Monitored)) * 100
MAN97	32.29	33.33	-3%
SA59	32.45	31.26	4%
SA60*	36.66	35.32	4%
SA81*	46.41	45.39	2%

* Adjustment factor of 1.0 applied

As demonstrated in Table C8, the percentage difference between modelled and monitored concentrations is deemed acceptable and is less than 25% in all cases, and less than 10% at all locations. This reduces uncertainties in the model predictions and provide a robust representation of pollutant concentrations in accordance with the guidance suggested in LAQM.TG(16)[2].

A graphical representation of the adjusted NO_2 concentrations is provided within Graph 2.

Graph 2 – Modelled vs Monitored NO_2



As PM10 and PM2.5 monitoring is not undertaken within the assessment extents, the NOx adjustment factor of 1.9183 was utilised to adjust model predictions of PM_{10} and $PM_{2.5}$ in accordance with the guidance provided within LAQM.TG(16)[2].

APPENDIX D – OPERATIONAL IMPACT ASSESSMENT RESULTS

Nitrogen Dioxide (NO_2)

Annual mean NO_2 concentrations were predicted for 2024 DM and DS scenarios and are summarised in Table D1.

Table D1: Predicted Annual Mean NO_2 Concentrations

Potential Impact		Predicted Annual Mean NO_2 Concentration (µg/m^3)		
		DM	DS	Change
R1	Residential - Chester Road	25.07	25.08	0.01
R2	Residential - Chester Road	26.18	26.23	0.05
R3	Residential - Chester Road	26.25	26.34	0.09
R4	Residential - Chester Road	**42.87**	**42.91**	0.04
R5	Residential - Chester Road	32.29	32.45	0.16
R6	Residential - Egerton Street	37.37	37.75	0.38
R7	Residential - Egerton Street	31.20	31.40	0.20
R8	Residential - Egerton Street	24.78	24.83	0.05
R9	Residential - Mancunian Way	27.12	27.17	0.05
R10	Residential - Chester Road	33.08	33.28	0.20
R11	Residential - City Road East	27.49	27.62	0.13
R12	Residential - City Road East	27.03	27.18	0.15
R13	Residential - City Road East	27.39	27.80	0.41
R14	Residential - Albion Street	29.20	29.26	0.06
R15	Residential - Albion Street	27.89	27.92	0.03
R16	Residential - Old Deansgate	27.58	27.63	0.05
R17	Residential - Bridgewater Viaduct	28.68	28.75	0.07
R18	Residential – Deansgate Square	26.52	26.60	0.08
R19	Residential - Deansgate Square	26.87	26.94	0.07
R20	Residential - Whitworth Street East	27.35	27.37	0.02
R21	Commercial - Great Jackson Street	35.14	35.42	0.28
R22	Commercial - Great Jackson Street	**40.22**	**40.36**	0.14
R23	Commercial - Egerton Street	39.88	**40.05**	0.17
R24	Commercial - Gaddum House	27.37	27.63	0.26
R25	Residential – Crown Street Phase 1	31.79	32.05	0.26

As indicated in Table D1, annual mean NO_2 concentrations exceeded the AQO at 3 sensitive human receptor locations considered. One new exceedance of the AQO is anticipated to arise as a result of the Proposed Development, this concerns location R23 in which the existing baseline DM concentrations is 0.18µg/m^3 below the AQO. As such, the exceedance is a result of negligible change. The remaining 22 human receptor locations were predicted to experience NO_2 concentrations below the relevant AQO.

Predicted impacts on annual mean NO_2 concentrations are summarised in Table D2.

Table D2: Predicted NO_2 Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Chester Road	0.02	75% or Less of AQO	Negligible
R2	Residential - Chester Road	0.13	75% or Less of AQO	Negligible
R3	Residential - Chester Road	0.23	75% or Less of AQO	Negligible
R4	Residential - Chester Road	0.10	103-109% of AQO	Negligible
R5	Residential - Chester Road	0.40	76-94% of AQO	Negligible
R6	Residential - Egerton Street	0.95	95-102% of AQO	Slight
R7	Residential - Egerton Street	0.50	76-94% of AQO	Negligible
R8	Residential - Egerton Street	0.12	75% or Less of AQO	Negligible
R9	Residential - Mancunian Way	0.13	75% or Less of AQO	Negligible
R10	Residential - Chester Road	0.50	76-94% of AQO	Negligible
R11	Residential - City Road East	0.33	75% or Less of AQO	Negligible
R12	Residential - City Road East	0.37	75% or Less of AQO	Negligible
R13	Residential - City Road East	1.03	75% or Less of AQO	Negligible
R14	Residential - Albion Street	0.15	75% or Less of AQO	Negligible
R15	Residential - Albion Street	0.08	75% or Less of AQO	Negligible
R16	Residential - Old Deansgate	0.13	75% or Less of AQO	Negligible
R17	Residential - Bridgewater Viaduct	0.18	75% or Less of AQO	Negligible
R18	Residential – Deansgate Square	0.20	75% or Less of AQO	Negligible
R19	Residential - Deansgate Square	0.18	75% or Less of AQO	Negligible
R20	Residential - Whitworth Street East	0.05	75% or Less of AQO	Negligible
R21	Commercial - Great Jackson Street	0.70	76-94% of AQO	Negligible
R22	Commercial - Great Jackson Street	0.35	95-102% of AQO	Negligible
R23	Commercial - Egerton Street	0.42	95-102% of AQO	Negligible
R24	Commercial - Gaddum House	0.65	75% or Less of AQO	Negligible
R25	Residential – Crown Street Phase 1	0.65	76-94% of AQO	Negligible

As indicated in Table D2 impacts on annual mean NO_2 concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be negligible at 24 receptor locations and slight at 1 receptor location. It is therefore considered that the overall impacts as a result of the proposed development are **not significant.** Further justifications are discussed in Section 5.2.3 of the main report.

Particulate Matter (PM_{10})

Annual mean PM_{10} concentrations were predicted for 2024 DM and DS scenarios and are summarised Table D3.

Table D3: Predicted Annual Mean PM_{10} Concentrations

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	Residential - Chester Road	14.47	14.47	0.00
R2	Residential - Chester Road	14.40	14.41	0.01
R3	Residential - Chester Road	14.49	14.52	0.03
R4	Residential - Chester Road	18.01	18.02	0.01
R5	Residential - Chester Road	15.97	16.01	0.04
R6	Residential - Egerton Street	17.89	17.99	0.10
R7	Residential - Egerton Street	16.46	16.52	0.06
R8	Residential - Egerton Street	14.42	14.43	0.01
R9	Residential - Mancunian Way	14.63	14.65	0.02
R10	Residential - Chester Road	16.20	16.25	0.05
R11	Residential - City Road East	14.66	14.70	0.04
R12	Residential - City Road East	14.49	14.54	0.05
R13	Residential - City Road East	14.49	14.60	0.11
R14	Residential - Albion Street	14.86	14.88	0.02
R15	Residential - Albion Street	14.57	14.58	0.01
R16	Residential - Old Deansgate	14.61	14.63	0.02
R17	Residential - Bridgewater Viaduct	14.91	14.93	0.02
R18	Residential – Deansgate Square	14.29	14.31	0.02
R19	Residential - Deansgate Square	14.40	14.42	0.02
R20	Residential - Whitworth Street East	14.29	14.30	0.01
R21	Commercial - Great Jackson Street	17.55	17.65	0.10
R22	Commercial - Great Jackson Street	19.77	19.82	0.05
R23	Commercial - Egerton Street	20.01	20.06	0.05
R24	Commercial - Gaddum House	14.58	14.65	0.07
R25	Residential – Crown Street Phase 1	15.98	16.06	0.08

As indicated in Table D3 annual mean PM_{10} concentrations were below the relevant AQO at all receptor locations considered.

Predicted impacts on annual mean PM_{10} concentrations are summarised in Table D4.

Table D4: Predicted PM_{10} Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Chester Road	0.00	75% or Less of AQO	Negligible
R2	Residential - Chester Road	0.02	75% or Less of AQO	Negligible
R3	Residential - Chester Road	0.07	75% or Less of AQO	Negligible
R4	Residential - Chester Road	0.02	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R5	Residential - Chester Road	0.10	75% or Less of AQO	Negligible
R6	Residential - Egerton Street	0.25	75% or Less of AQO	Negligible
R7	Residential - Egerton Street	0.15	75% or Less of AQO	Negligible
R8	Residential - Egerton Street	0.02	75% or Less of AQO	Negligible
R9	Residential - Mancunian Way	0.05	75% or Less of AQO	Negligible
R10	Residential - Chester Road	0.13	75% or Less of AQO	Negligible
R11	Residential - City Road East	0.10	75% or Less of AQO	Negligible
R12	Residential - City Road East	0.12	75% or Less of AQO	Negligible
R13	Residential - City Road East	0.27	75% or Less of AQO	Negligible
R14	Residential - Albion Street	0.05	75% or Less of AQO	Negligible
R15	Residential - Albion Street	0.02	75% or Less of AQO	Negligible
R16	Residential - Old Deansgate	0.05	75% or Less of AQO	Negligible
R17	Residential - Bridgewater Viaduct	0.05	75% or Less of AQO	Negligible
R18	Residential – Deansgate Square	0.05	75% or Less of AQO	Negligible
R19	Residential - Deansgate Square	0.05	75% or Less of AQO	Negligible
R20	Residential - Whitworth Street East	0.03	75% or Less of AQO	Negligible
R21	Commercial - Great Jackson Street	0.25	75% or Less of AQO	Negligible
R22	Commercial - Great Jackson Street	0.13	75% or Less of AQO	Negligible
R23	Commercial - Egerton Street	0.12	75% or Less of AQO	Negligible
R24	Commercial - Gaddum House	0.18	75% or Less of AQO	Negligible
R25	Residential – Crown Street Phase 1	0.20	75% or Less of AQO	Negligible

As indicated in Table D4 impacts on annual mean PM_{10} concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be **negligible** at all receptor locations. It is therefore considered that the overall impacts as a result of the Proposed Development are **not significant.** Further justifications are discussed in Section 5.2.3 of the main report.

Particulate Matter ($PM_{2.5}$)

Annual mean $PM_{2.5}$ concentrations were predicted for 2024 DM and DS scenarios and are summarised Table D5.

Table D5: Predicted Annual Mean $PM_{2.5}$ Concentrations

Potential Impact		Predicted Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	Residential - Chester Road	9.16	9.17	0.01
R2	Residential - Chester Road	9.14	9.15	0.01
R3	Residential - Chester Road	9.19	9.20	0.01
R4	Residential - Chester Road	11.23	11.24	0.01
R5	Residential - Chester Road	10.03	10.06	0.03

Potential Impact		Predicted Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)		
		DM	DS	Change
R6	Residential - Egerton Street	11.10	11.16	0.06
R7	Residential - Egerton Street	10.28	10.31	0.03
R8	Residential - Egerton Street	9.13	9.14	0.01
R9	Residential - Mancunian Way	9.21	9.22	0.01
R10	Residential - Chester Road	10.10	10.14	0.04
R11	Residential - City Road East	9.24	9.26	0.02
R12	Residential - City Road East	9.14	9.17	0.03
R13	Residential - City Road East	9.15	9.20	0.05
R14	Residential - Albion Street	9.36	9.37	0.01
R15	Residential - Albion Street	9.19	9.20	0.01
R16	Residential - Old Deansgate	9.21	9.22	0.01
R17	Residential - Bridgewater Viaduct	9.38	9.39	0.01
R18	Residential – Deansgate Square	9.03	9.04	0.01
R19	Residential - Deansgate Square	9.09	9.10	0.01
R20	Residential - Whitworth Street East	9.04	9.05	0.01
R21	Commercial - Great Jackson Street	10.84	10.89	0.05
R22	Commercial - Great Jackson Street	12.06	12.09	0.03
R23	Commercial - Egerton Street	12.24	12.27	0.03
R24	Commercial - Gaddum House	9.19	9.23	0.04
R25	Residential – Crown Street Phase 1	9.98	10.02	0.04

As indicated in Table D5 annual mean $PM_{2.5}$ concentrations were below the relevant AQO at all receptor locations considered.

Predicted impacts on annual mean $PM_{2.5}$ concentrations are summarised in Table D6.

Table D6: Predicted $PM_{2.5}$ Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Chester Road	0.04	75% or Less of AQO	Negligible
R2	Residential - Chester Road	0.04	75% or Less of AQO	Negligible
R3	Residential - Chester Road	0.04	75% or Less of AQO	Negligible
R4	Residential - Chester Road	0.04	75% or Less of AQO	Negligible
R5	Residential - Chester Road	0.12	75% or Less of AQO	Negligible
R6	Residential - Egerton Street	0.24	75% or Less of AQO	Negligible
R7	Residential - Egerton Street	0.12	75% or Less of AQO	Negligible
R8	Residential - Egerton Street	0.04	75% or Less of AQO	Negligible
R9	Residential - Mancunian Way	0.04	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R10	Residential - Chester Road	0.16	75% or Less of AQO	Negligible
R11	Residential - City Road East	0.08	75% or Less of AQO	Negligible
R12	Residential - City Road East	0.12	75% or Less of AQO	Negligible
R13	Residential - City Road East	0.20	75% or Less of AQO	Negligible
R14	Residential - Albion Street	0.04	75% or Less of AQO	Negligible
R15	Residential - Albion Street	0.04	75% or Less of AQO	Negligible
R16	Residential - Old Deansgate	0.04	75% or Less of AQO	Negligible
R17	Residential - Bridgewater Viaduct	0.04	75% or Less of AQO	Negligible
R18	Residential – Deansgate Square	0.04	75% or Less of AQO	Negligible
R19	Residential - Deansgate Square	0.04	75% or Less of AQO	Negligible
R20	Residential - Whitworth Street East	0.04	75% or Less of AQO	Negligible
R21	Commercial - Great Jackson Street	0.20	75% or Less of AQO	Negligible
R22	Commercial - Great Jackson Street	0.12	75% or Less of AQO	Negligible
R23	Commercial - Egerton Street	0.12	75% or Less of AQO	Negligible
R24	Commercial - Gaddum House	0.16	75% or Less of AQO	Negligible
R25	Residential – Crown Street Phase 1	0.16	75% or Less of AQO	Negligible

As indicated in Table D6 impacts on annual mean $PM_{2.5}$ concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be **negligible** at all receptor locations. It is therefore considered that the overall impacts as a result of the Proposed Development are **not significant.** Further justifications are discussed in Section 5.2.3.

APPENDIX E – SENSITIVITY ANALYSIS RERULTS

Sensitivity analysis was undertaken to assess associated road vehicle exhaust emissions impacts based on the use of 2024 traffic data using 2019 emission factors. The use of 2019 emission factors assumes that vehicle emission factors will not improve in line with current predictions and future emission factors will remain consistent with those predicted for the baseline year. This ensures a worst-case scenario.

The results are detailed in the following Sections.

Nitrogen Dioxide (NO_2)

Annual mean NO_2 concentrations were predicted for 2024 DM and DS scenarios and are summarised in Table E1.

Table E1: Predicted Annual Mean NO_2 Concentrations

Potential Impact		Predicted Annual Mean NO_2 Concentration (µg/m^3)		
		DM	DS	Change
R1	Residential - Chester Road	33.85	33.87	0.02
R2	Residential - Chester Road	35.76	35.84	0.08
R3	Residential - Chester Road	35.79	35.94	0.15
R4	Residential - Chester Road	**61.30**	**61.37**	0.07
R5	Residential - Chester Road	**45.38**	**45.63**	0.25
R6	Residential - Egerton Street	**53.03**	**53.61**	0.58
R7	Residential - Egerton Street	**43.36**	**43.67**	0.31
R8	Residential - Egerton Street	33.38	33.45	0.07
R9	Residential - Mancunian Way	35.66	35.75	0.09
R10	Residential - Chester Road	**45.03**	**45.34**	0.31
R11	Residential - City Road East	36.20	36.41	0.21
R12	Residential - City Road East	35.45	35.69	0.24
R13	Residential - City Road East	35.92	36.55	0.63
R14	Residential - Albion Street	38.62	38.71	0.09
R15	Residential - Albion Street	36.70	36.75	0.05
R16	Residential - Old Deansgate	36.20	36.29	0.09
R17	Residential - Bridgewater Viaduct	38.10	38.21	0.11
R18	Residential – Deansgate Square	34.61	34.75	0.14
R19	Residential - Deansgate Square	35.14	35.24	0.10
R20	Residential - Whitworth Street East	35.80	35.83	0.03
R21	Commercial - Great Jackson Street	**48.26**	**48.69**	0.43
R22	Commercial - Great Jackson Street	**56.03**	**56.24**	0.21
R23	Commercial - Egerton Street	**56.44**	**56.69**	0.25
R24	Commercial - Gaddum House	36.00	36.42	0.42
R25	Residential – Crown Street Phase 1	**43.16**	**43.58**	0.42

As indicated in Table E1, annual mean NO_2 concentrations exceeded the AQO at 9 sensitive human receptor locations

considered. No new exceedances of the AQO were anticipated to arise as a result of the Proposed Development. The remaining 16 human receptor locations were predicted to experience NO_2 concentrations below the relevant AQO.

Predicted impacts on annual mean NO_2 concentrations are summarised in Table E2.

Table E2: Predicted NO_2 Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Chester Road	0.05	76-94% of AQO	Negligible
R2	Residential - Chester Road	0.20	76-94% of AQO	Negligible
R3	Residential - Chester Road	0.37	76-94% of AQO	Negligible
R4	Residential - Chester Road	0.18	110+ of AQO	Negligible
R5	Residential - Chester Road	0.63	110+ of AQO	Moderate
R6	Residential - Egerton Street	1.45	110+ of AQO	Moderate
R7	Residential - Egerton Street	0.78	110+ of AQO	Moderate
R8	Residential - Egerton Street	0.18	76-94% of AQO	Negligible
R9	Residential - Mancunian Way	0.23	76-94% of AQO	Negligible
R10	Residential - Chester Road	0.78	110+ of AQO	Moderate
R11	Residential - City Road East	0.52	76-94% of AQO	Negligible
R12	Residential - City Road East	0.60	76-94% of AQO	Negligible
R13	Residential - City Road East	1.57	76-94% of AQO	Slight
R14	Residential - Albion Street	0.23	95-102% of AQO	Negligible
R15	Residential - Albion Street	0.12	76-94% of AQO	Negligible
R16	Residential - Old Deansgate	0.22	76-94% of AQO	Negligible
R17	Residential - Bridgewater Viaduct	0.27	95-102% of AQO	Negligible
R18	Residential – Deansgate Square	0.35	76-94% of AQO	Negligible
R19	Residential - Deansgate Square	0.25	76-94% of AQO	Negligible
R20	Residential - Whitworth Street East	0.08	76-94% of AQO	Negligible
R21	Commercial - Great Jackson Street	1.08	110+ of AQO	Moderate
R22	Commercial - Great Jackson Street	0.53	110+ of AQO	Moderate
R23	Commercial - Egerton Street	0.63	110+ of AQO	Moderate
R24	Commercial - Gaddum House	1.05	76-94% of AQO	Negligible
R25	Residential – Crown Street Phase 1	1.05	103-109% of AQO	Moderate

As indicated in Table E2 impacts on annual mean NO_2 concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be negligible at 16 receptor locations, slight at 1 receptor location and moderate at 8 receptor locations.

Particulate Matter (PM_{10})

Annual mean PM_{10} concentrations were predicted for 2024 DM and DS scenarios and are summarised Table E3.

Table E3: Predicted Annual Mean PM_{10} Concentrations

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	Residential - Chester Road	15.33	15.34	0.01
R2	Residential - Chester Road	15.28	15.30	0.02
R3	Residential - Chester Road	15.37	15.40	0.03
R4	Residential - Chester Road	19.14	19.15	0.01
R5	Residential - Chester Road	16.96	17.00	0.04
R6	Residential - Egerton Street	18.93	19.04	0.11
R7	Residential - Egerton Street	17.39	17.45	0.06
R8	Residential - Egerton Street	15.28	15.29	0.01
R9	Residential - Mancunian Way	15.53	15.55	0.02
R10	Residential - Chester Road	17.18	17.24	0.06
R11	Residential - City Road East	15.56	15.60	0.04
R12	Residential - City Road East	15.38	15.43	0.05
R13	Residential - City Road East	15.38	15.49	0.11
R14	Residential - Albion Street	15.76	15.78	0.02
R15	Residential - Albion Street	15.47	15.47	0.00
R16	Residential - Old Deansgate	15.50	15.51	0.01
R17	Residential - Bridgewater Viaduct	15.83	15.85	0.02
R18	Residential – Deansgate Square	15.16	15.19	0.03
R19	Residential - Deansgate Square	15.28	15.30	0.02
R20	Residential - Whitworth Street East	15.17	15.18	0.01
R21	Commercial - Great Jackson Street	18.58	18.69	0.11
R22	Commercial - Great Jackson Street	20.88	20.93	0.05
R23	Commercial - Egerton Street	21.08	21.14	0.06
R24	Commercial - Gaddum House	15.47	15.55	0.08
R25	Residential – Crown Street Phase 1	16.96	17.05	0.09

As indicated in Table E3 annual mean PM_{10} concentrations were below the relevant AQO at all receptor locations considered.

Predicted impacts on annual mean PM_{10} concentrations are summarised in Table E4.

Table E4: Predicted PM_{10} Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Chester Road	0.02	75% or Less of AQO	Negligible
R2	Residential - Chester Road	0.05	75% or Less of AQO	Negligible
R3	Residential - Chester Road	0.08	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R4	Residential - Chester Road	0.02	75% or Less of AQO	Negligible
R5	Residential - Chester Road	0.10	75% or Less of AQO	Negligible
R6	Residential - Egerton Street	0.27	75% or Less of AQO	Negligible
R7	Residential - Egerton Street	0.15	75% or Less of AQO	Negligible
R8	Residential - Egerton Street	0.02	75% or Less of AQO	Negligible
R9	Residential - Mancunian Way	0.05	75% or Less of AQO	Negligible
R10	Residential - Chester Road	0.15	75% or Less of AQO	Negligible
R11	Residential - City Road East	0.10	75% or Less of AQO	Negligible
R12	Residential - City Road East	0.12	75% or Less of AQO	Negligible
R13	Residential - City Road East	0.27	75% or Less of AQO	Negligible
R14	Residential - Albion Street	0.05	75% or Less of AQO	Negligible
R15	Residential - Albion Street	0.00	75% or Less of AQO	Negligible
R16	Residential - Old Deansgate	0.02	75% or Less of AQO	Negligible
R17	Residential - Bridgewater Viaduct	0.05	75% or Less of AQO	Negligible
R18	Residential – Deansgate Square	0.07	75% or Less of AQO	Negligible
R19	Residential - Deansgate Square	0.05	75% or Less of AQO	Negligible
R20	Residential - Whitworth Street East	0.02	75% or Less of AQO	Negligible
R21	Commercial - Great Jackson Street	0.28	75% or Less of AQO	Negligible
R22	Commercial - Great Jackson Street	0.13	75% or Less of AQO	Negligible
R23	Commercial - Egerton Street	0.15	75% or Less of AQO	Negligible
R24	Commercial - Gaddum House	0.20	75% or Less of AQO	Negligible
R25	Residential – Crown Street Phase 1	0.23	75% or Less of AQO	Negligible

As indicated in Table E4 impacts on annual mean PM_{10} concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be **negligible** at all receptor locations.

Particulate Matter ($PM_{2.5}$)

Annual mean $PM_{2.5}$ concentrations were predicted for 2024 DM and DS scenarios and are summarised Table E5.

Table E5: Predicted Annual Mean $PM_{2.5}$ Concentrations

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	Residential - Chester Road	9.81	9.81	0.00
R2	Residential - Chester Road	9.80	9.81	0.01
R3	Residential - Chester Road	9.85	9.86	0.01
R4	Residential - Chester Road	12.17	12.18	0.01
R5	Residential - Chester Road	10.80	10.83	0.03
R6	Residential - Egerton Street	11.94	12.01	0.07

Potential Impact		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R7	Residential - Egerton Street	11.00	11.04	0.04
R8	Residential - Egerton Street	9.77	9.78	0.01
R9	Residential - Mancunian Way	9.88	9.89	0.01
R10	Residential - Chester Road	10.86	10.89	0.03
R11	Residential - City Road East	9.90	9.92	0.02
R12	Residential - City Road East	9.80	9.82	0.02
R13	Residential - City Road East	9.80	9.87	0.07
R14	Residential - Albion Street	10.04	10.05	0.01
R15	Residential - Albion Street	9.86	9.86	0.00
R16	Residential - Old Deansgate	9.87	9.88	0.01
R17	Residential - Bridgewater Viaduct	10.06	10.08	0.02
R18	Residential – Deansgate Square	9.67	9.69	0.02
R19	Residential - Deansgate Square	9.74	9.75	0.01
R20	Residential - Whitworth Street East	9.69	9.70	0.01
R21	Commercial - Great Jackson Street	11.64	11.70	0.06
R22	Commercial - Great Jackson Street	12.95	12.98	0.03
R23	Commercial - Egerton Street	13.13	13.16	0.03
R24	Commercial - Gaddum House	9.85	9.90	0.05
R25	Residential – Crown Street Phase 1	10.72	10.77	0.05

As indicated in Table E5 annual mean $PM_{2.5}$ concentrations were below the relevant AQO at all receptor locations considered.

Predicted impacts on annual mean $PM_{2.5}$ concentrations are summarised in Table E6.

Table E6: Predicted $PM_{2.5}$ Impacts

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Chester Road	0.00	75% or Less of AQO	Negligible
R2	Residential - Chester Road	0.04	75% or Less of AQO	Negligible
R3	Residential - Chester Road	0.04	75% or Less of AQO	Negligible
R4	Residential - Chester Road	0.04	75% or Less of AQO	Negligible
R5	Residential - Chester Road	0.12	75% or Less of AQO	Negligible
R6	Residential - Egerton Street	0.28	75% or Less of AQO	Negligible
R7	Residential - Egerton Street	0.16	75% or Less of AQO	Negligible
R8	Residential - Egerton Street	0.04	75% or Less of AQO	Negligible
R9	Residential - Mancunian Way	0.04	75% or Less of AQO	Negligible
R10	Residential - Chester Road	0.12	75% or Less of AQO	Negligible

Potential Impact		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R11	Residential - City Road East	0.08	75% or Less of AQO	Negligible
R12	Residential - City Road East	0.08	75% or Less of AQO	Negligible
R13	Residential - City Road East	0.28	75% or Less of AQO	Negligible
R14	Residential - Albion Street	0.04	75% or Less of AQO	Negligible
R15	Residential - Albion Street	0.00	75% or Less of AQO	Negligible
R16	Residential - Old Deansgate	0.04	75% or Less of AQO	Negligible
R17	Residential - Bridgewater Viaduct	0.08	75% or Less of AQO	Negligible
R18	Residential – Deansgate Square	0.08	75% or Less of AQO	Negligible
R19	Residential - Deansgate Square	0.04	75% or Less of AQO	Negligible
R20	Residential - Whitworth Street East	0.04	75% or Less of AQO	Negligible
R21	Commercial - Great Jackson Street	0.24	75% or Less of AQO	Negligible
R22	Commercial - Great Jackson Street	0.12	75% or Less of AQO	Negligible
R23	Commercial - Egerton Street	0.12	75% or Less of AQO	Negligible
R24	Commercial - Gaddum House	0.20	75% or Less of AQO	Negligible
R25	Residential – Crown Street Phase 1	0.20	75% or Less of AQO	Negligible

As indicated in Table E6 impacts on annual mean $PM_{2.5}$ concentrations as a result of road vehicle exhaust emissions associated with the development were predicted to be **negligible** at all receptor locations.

APPENDIX F – CONSTRUCTION PHASE METHODOLOGY

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction'[3].

Activities are divided into four types to reflect their different potential impacts. These are:

- Demolition
- Earthworks;
- Construction; and
- Trackout.

The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in exposure to PM_{10} and $PM_{2.5}$.

The assessment steps are detailed below.

Step 1

Step 1 screens the requirement for a more detailed assessment. Should human receptors be identified within 350m from the site boundary or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should proceed to Step 2. Additionally, should ecological receptors be identified within 50m of the boundary site or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should also proceed to Step 2.

Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

Step 2

Step 2 assesses the risk of potential dust impacts. A site is allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and
- The sensitivity of the area to dust impacts, which can be defined as low, medium or high sensitivity (Step 2B).

The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied. Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table F1.

Table F1: Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Demolition	• Total building volume greater than 50,000m^3 • Potentially dusty construction material (e.g. concrete) • On-site crushing and screening • Demolition activities greater than 20m above ground level
	Earthworks	• Total site area greater than 10,000m^2 • Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size)

Magnitude	Activity	Criteria
		• More than 10 heavy earth moving vehicles active at any one time • Formation of bunds greater than 8m in height • More than 100,000 tonnes of material moved
	Construction	• Total building volume greater than 100,000m^3 • On site concrete batching • Sandblasting
	Trackout	• More than 50 Heavy Duty Vehicle (HDV) trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	Demolition	• Total building volume 20,000m^3 to 50,000m^3 • Potentially dusty construction material • Demolition activities 10m to 20m above ground level
	Earthworks	• Total site area 2,500m^2 to 10,000m^2 • Moderately dusty soil type (e.g. silt) • 5 to 10 heavy earth moving vehicles active at any one time • Formation of bunds 4m to 8m in height • Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	• Total building volume 25,000m^3 to 100,000m^3 • Potentially dusty construction material (e.g. concrete) • On site concrete batching
	Trackout	• 10 to 50 HDV trips per day • Moderately dusty surface material (e.g. high clay content) • Unpaved road length 50m to 100m
Small	Demolition	• Total building volume under 20,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber) • Demolition activities less than 10m above ground level • Demolition during wetter months
	Earthworks	• Total site area less than 2,500m^2 • Soil type with large grain size (e.g. sand) • Less than 5 heavy earth moving vehicles active at any one time • Formation of bunds less than 4m in height • Total material moved less than 20,000 tonnes • Earthworks during wetter months
	Construction	• Total building volume less than 25,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	• <10 HDV (3.5t) outward movements in any one day • Surface material with low potential for dust release • Unpaved road length <50m

Step 2B defines the sensitivity of the area around the development site for construction, earthworks and trackout. The factors influencing the sensitivity of the area are shown in Table F2.

Table F2: Examples of Factors Defining Sensitivity of an Area

Sensitivity	Examples	
	Human Receptors	**Ecological Receptors**
High	• Users expect of high levels of amenity • High aesthetic or value property	• Internationally or nationally designated site e.g. Special Area of Conservation

Sensitivity	Examples	
	Human Receptors	**Ecological Receptors**
	• People expected to be present continuously for extended periods of time • Locations where members of the public are exposed over a time period relevant to the AQO for PM_{10} e.g. residential properties, hospitals, schools and residential care homes	
Medium	• Users would expect to enjoy a reasonable level of amenity • Aesthetics or value of their property could be diminished by soiling • People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks and places of work	• Nationally designated site e.g. Sites of Special Scientific Interest
Low	• Enjoyment of amenity would not reasonably be expected • Property would not be expected to be diminished in appearance • Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, playing fields, farmland, footpaths, short term car park and roads	• Locally designated site e.g. Local Nature Reserve

The guidance also provides the following factors to consider when determining the sensitivity of an area to potential dust impacts during the construction phase:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and
- Any known specific receptor sensitivities which go beyond the classifications given in the document.

These factors were considered in the undertaking of this assessment.

The sensitivity of the area to dust soiling effects on people and property is shown in Table F3.

Table F3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	**Less than 50**	**Less than 100**	**Less than 350**
High	More than 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Table F4 outlines the sensitivity of the area to human health impacts.

Table F4: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
High	Greater than 32µg/m^3	More than 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32µg/m^3	More than 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28µg/m^3	More than 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	Less than 24µg/m^3	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
	Less than 24µg/m^3	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	Greater than 32µg/m^3	More than 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28 - 32µg/m^3	More than 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24 - 28µg/m^3	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Less than 24µg/m^3	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Low	-	More than 1	Low	Low	Low	Low	Low

Table F5 outlines the sensitivity of the area to ecological impacts.

Table F5: Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	Less than 20	Less than 50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C combines the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated

impacts.

Table F6 outlines the risk category from demolition activities.

Table F6: Dust Risk Category from Demolition

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

Table F7 outlines the risk category from earthworks and construction activities.

Table F7: Dust Risk Category from Earthworks and Construction

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table F8 outlines the risk category from trackout.

Table F8: Dust Risk Category from Trackout

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

Step 3

Step 3 requires the identification of site-specific mitigation measures within the IAQM guidance to reduce potential dust impacts based upon the relevant risk categories identified in Step 2. For sites with negligible risk mitigation measures beyond those required by legislation are not required. However, additional controls may be applied as part of good practice.

Step 4

Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'.

APPENDIX G – ASSESSORS CV

Lewis Ellison

Technical Director

MOcean, AMIEnvSc, MIAQM

KEY EXPERIENCE

Lewis is a Technical Director with specialist experience in the air quality sectors. His key capabilities include:

- Production of Air Quality Assessments to the Department for Environment, Food and Rural Affairs (DEFRA), Environment Agency and Environmental Protection UK (EPUK) methodologies for clients from the residential, retail and commercial sectors.
- Detailed dispersion modelling of road vehicle emissions using ADMS-Roads. Studies have included impact assessment of pollutant concentrations at various floor levels and assessment of suitability of development sites for proposed end-use.
- Assessment of dust impacts from construction sites to the Institute of Air Quality Management (IAQM) methodology.
- Assessment of Odour Impact from commercial and industrial processes in line with Environment Agency (EA) and IAQM methodologies and guidance
- Quantification of Ecological Impacts associated with Nitrogen and Acid Deposition from industrial processes
- Production of air quality mitigation strategies for developments throughout the UK.

SELECT PROJECTS SUMMARY

Permit Application Support

- Elliot Hire Salford
- Elliot Hire Wakefield
- Elliot Hire Scunthorpe

ES Chapters

- Lyle Park West, Newham – residential development in close proximity to an active industrial estate.
- Deansgate, Manchester – residential multistorey development in the centre of Manchester.
- Land West of Stevenage – 1350 residential unit development with the potential to negatively impact local air quality

Air Quality

- Goulton Street Hull – Outline planning permission for 7 industrial units within Hull
- Empire Cinema, Birmingham – Diffusion tube survey and air quality assessment for an assisted living accommodation
- Tirrell's Lane, Tenbury Wells – residential assessment in the village of Tenbury Wells.

Odour Assessments

- Gowanbank, Forfar – Odour survey to support a residential development in close proximity to Gowanbank recycling centre
- Squires Close, Pocklington – Odour risk assessment in support of a residential in close proximity to a sewage treatment works
- Hawthorn Fields, Rufforth - Odour risk assessment in support of a residential in close proximity to a waste water treatment works

Dust Assessment

- Liverpool Docks – Construction dust monitoring survey
- Lyle Park West – Dust impact assessment from adjacent concrete batching plant
- High Street, Burton – Construction dust risk assessment

London Experience

- Gurnell Leisure Centre – mixed use development including residential, sports and commercial land use
- Springfield Village Wandsworth – residential development and extension to the existing hospital building
- Evelyn House, Greenwich – residential apartment block

Monitoring & Surveying Experience

- Liverpool Waters – Frisbee Dust gauge monitoring
- Gownbank, Forfar – Field odour survey "sniff test"
- Empire Cinema Birmingham – Diffusion tube survey

QUALIFICATIONS

- Masters of Geological Oceanography
- Odour Acuity Certified